

HIV/AIDS Epi Updates

July 2010



Public Health
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To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

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Information to the readers of *HIV/AIDS Epi Updates*

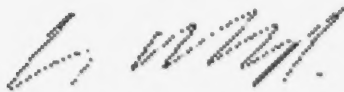
The Surveillance and Risk Assessment Division of the Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, is pleased to provide you with the July 2010 edition of *HIV/AIDS Epi Updates*.

The Centre conducts national surveillance and research on the epidemiology of HIV/AIDS and other blood-borne and sexually transmitted infections. As part of this mandate, *HIV/AIDS Epi Updates* are produced to summarize recent trends and developments related to the HIV situation in Canada.

Note that previous editions of *HIV/AIDS Epi Updates* were published in a single bound volume. Starting with this 2010 edition, the *HIV/AIDS Epi Updates* will be published in a booklet format so that each individual *Epi Updates* can be revised and updated separately as new data become available. Each *Epi Updates* will have a date noted on the first page to indicate when it was most recently revised.

All *Epi Updates* are available at the address noted above and also at our website: <http://www.phac-aspc.gc.ca/>. The *HIV/AIDS Epi Updates* are complementary to other Centre materials which are also available at the website.

Sincerely,



Chris Archibald MDCM, MHSc, FRCPC
Director

Acknowledgements

National level HIV and AIDS surveillance is possible as a result of all provinces and territories participating in, and setting directions for, HIV and AIDS surveillance. Accordingly, the Centre for Communicable Diseases and Infection Control acknowledges the provincial/territorial HIV/AIDS coordinators, public health units, laboratories, health care providers and reporting physicians for providing the non nominal confidential data that enable this report to be published. Without their close collaboration and participation in HIV and AIDS surveillance, the publication of this report would not have been possible. We are also thankful to the researchers across Canada who share their research findings with us in a timely manner for inclusion in the HIV/AIDS Epi Updates.

We also thank Web Site and Intranet Operations, Public Health Agency of Canada, for their contribution in helping us host the report on the Internet.

And finally, we would also like to thank the contributions made by Marion Pogson in editing the report.

N.B. This document must be cited as the source for any information extracted and used from it.

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Overview of Epi Updates 2010 Development and Methodology

Objective

The primary objective of the PHAC Epi Updates publication is to provide up-to-date information on trends and developments in the epidemiology of HIV and associated risk behaviours in Canada. Prior to 2007, the Epi Updates were published on an annual basis. A new approach has been developed, specifically, a staggered approach to publication of the chapters. Each chapter will now be published as a stand-alone document that will be updated in the future as new epidemiologic data become available. In 2010, the following chapters were updated and published as stand-alone booklets:

- Chapter 1:** National HIV Prevalence and Incidence Estimates in Canada for 2008
- Chapter 2:** Undiagnosed HIV Infections in Canada
- Chapter 3:** HIV Testing and Surveillance Systems in Canada
- Chapter 4:** HIV/AIDS Among Youth in Canada
- Chapter 5:** HIV/AIDS Among Women in Canada
- Chapter 6:** HIV/AIDS Among Older Canadians
- Chapter 7:** Perinatal HIV Transmission in Canada
- Chapter 8:** HIV/AIDS Among Aboriginal Peoples of Canada
- Chapter 9:** HIV/AIDS Among Gay, Bisexual and Other Men Who Have Sex with Men in Canada
- Chapter 10:** HIV/AIDS Among People Who Inject Drugs in Canada
- Chapter 11:** HIV Strain Surveillance in Canada
- Chapter 12:** Primary HIV Antiretroviral Drug Resistance in Canada

These chapters attempt to provide epidemiologic findings updated since the publication of the last Epi Updates in 2007; thus the searches described below focused on the period January 1, 2006, to December 31, 2009. In chapters describing populations that have not been the subject of many new research studies, publications and reports from earlier years were included in the current Epi Updates.

Search Methodology Used

A detailed search strategy was developed by a PHAC health librarian to generate a list of relevant HIV literature citations within the context of the Canadian population. A broad search was done using the SCOPUS database. Search terms included "HIV" and "Canada". This yielded a large number of results, as it was designed to be a comprehensive search strategy.

Articles were screened by title and/or abstract using pre-defined inclusion/exclusion criteria.

To identify other relevant documents, such as reports, news articles and exposés, a Web search was done using search engines such as Google™; this search also used the search terms "HIV" and "Canada". RSS (Really Simple Syndication) feeds were set up through the Health Canada Library to locate any newly published media report within the parameters of the literature search objectives.

Inclusion criteria

Articles meeting the following criteria were included in the Epi Updates reference materials:

- Articles that referred to the vulnerable populations as specified in the Federal Initiative to Address HIV/AIDS in Canada, which include Aboriginal Peoples, at-risk youth, women, people who inject drugs (IDU), men who have sex with men (MSM), prison inmates, people from countries where HIV is endemic, people living with HIV/AIDS.
- Independent variable: HIV-associated risk behaviours, social determinants of health.
- Dependant variable: HIV and associated outcomes.
- Study design: surveillance, epidemiologic studies, socio-behavioural, relevant randomized controlled trial (RCT), qualitative research and community-based research.
- Country/populations: Canada/populations of people who reside in Canada.
- Peer-reviewed literature.
- Grey literature, such as agency reports, conference abstracts.
- Articles are written in English or French.

Exclusion criteria

Articles meeting the following criteria were excluded from the Epi Updates reference list:

- Animal RCTs.
- Drug trials.
- Program evaluation reports, discussions on surveillance methodology, articles that include HIV and populations of interest but focus on condition/topic other than HIV (e.g. cardiovascular disease in HIV populations), similar articles published with different titles/order of authors.
- Articles written in languages other than French or English.



HIV/AIDS *Epi Updates*

Public Health Agency of Canada

www.phac-aspc.gc.ca/hast-vsmt/

JULY 2010

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Glossary

A Guide to HIV/AIDS Epidemiological and Surveillance Terms is available. The guide contains over 65 terms and over 20 frequently asked questions, and is accessible at <http://www.phac-aspc.gc.ca/publicat/haest-tesvs/index-eng.php>. Hard copies may be obtained through the Surveillance and Risk Assessment Division, from the address listed under the Information to Readers of HIV/AIDS Epi Updates section. A selected number of abbreviations/acronyms and terms that may be useful when reading HIV/AIDS Epi Updates are listed below.

Acronyms/Abbreviations

AIDS	Acquired immunodeficiency syndrome
CCDIC	Centre for Communicable Diseases and Infection Control
HAART	Highly Active Anti-Retroviral Therapy
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
IDU	People who inject drugs
MSM	Men who have sex with men
NEP	Needle exchange program
PHAC	Public Health Agency of Canada
STBBI	Sexually transmitted and blood-borne infections
UNAIDS	Joint United Nations Programme on HIV/AIDS
WHO	World Health Organization

Terms

Aboriginals: Aboriginals include the First Nations, Inuit and Métis people of Canada.

CD4 count: A test that indicates the strength of one's immune system and can be used to predict the risk of complications and debilitating infections. This is often used in combination with the HIV viral load test.

Cohort Study: The purpose of a cohort study is to investigate the development of new occurrences of a disease or to investigate how responses to treatment are related to specific factors. These factors can be recorded at the beginning of the study and/or during the course of the study. A cohort study starts with a group of people, identified as a cohort, who will be participants in the study. The cohort is followed for a specified time period, which can be weeks, months, years or decades. Follow-up data are collected at regularly defined periods either through the use of questionnaires, personal interviews, laboratory testing, medical examinations, or a combination of these methods. A cohort study is sometimes referred to as a prospective or longitudinal study.

Co-infection: Having two infections at the same time. For example, a person infected with both HIV and hepatitis C or HIV and tuberculosis, has a co-infection. With co-infections the progression of either disease can potentially be accelerated as a result of infection with the other disease.

Endemic: For the purposes of HIV surveillance, "HIV-endemic countries" are generally defined as those that have an adult prevalence (ages 15-49) of HIV that is 1.0% or greater and one of the following: 50% or more of HIV cases attributed to heterosexual transmission; a male to female ratio of 2:1 or less among prevalent infections; or HIV prevalence greater than or equal to 2% among women receiving prenatal care.

Exposure Category: In HIV and AIDS surveillance, exposure category refers to the most likely way a person became infected with the HIV virus, that is, the most likely route through which HIV was transmitted to that person.

Highly Active Anti-Retroviral Therapy: A therapy that involves multiple anti-HIV drugs and is prescribed, before AIDS symptoms are developed, to HIV positive people.

Incidence: Incidence is the number of new events of a specific disease during a specified period of time in a specified population. HIV incidence is the number of new HIV infections occurring in a specified period of time in a specified population.

Methodology: The methodology section of a report or research study describes how the study was conducted (the methods) and the principles used by study investigators. These methods include how participants were recruited and how the data were collected, organized and analyzed.

Notifiable Disease: A disease that is considered to be of such importance to public health that its occurrence is required to be reported to public health authorities.

Perinatal Transmission: The transmission of HIV from an HIV-infected mother to her child either in utero, during childbirth, or through breastfeeding.

Person Years: Person years describes the length of time of experience or exposure of a group of people who have been observed for varying periods of time. It is the sum total of the length of time each person has been exposed, observed or at risk. You will sometimes see person years reported as PY or py. Person years are often used as the denominator in expressing incidence rate.

Pilot phase: Activity that has been organized as a trial or test period.

Population at Risk: The population at risk represents those persons at risk of contracting a disease.

Prevalence: Prevalence is the total number of people with a specific disease or health condition living in a defined population at a particular time. HIV prevalence among Canadians is the total number of people living with HIV infection (including those with AIDS) in Canada at a particular time.

Rate: A rate is an expression of the frequency with which an event occurs in a defined population in a specified period of time. In HIV/AIDS research, a rate can be the proportion of a population with a particular "event", such as HIV infection, occurring during a specified time period.

Risk Factor: An aspect of someone's behaviour or lifestyle, a characteristic that a person was born with, or an event that he or she has been exposed to that is known to be associated with a health-related condition. A behavioural risk factor describes a specific behaviour that carries a proven risk of a particular outcome. In HIV/AIDS research, you will often see the term "HIV-related risk behaviour" to describe a behaviour that, when practised, carries a proven risk of HIV infection.

Second-generation surveillance: Second generation surveillance for HIV/AIDS is the regular, systematic collection, analysis and interpretation of information for use in tracking and describing changes in the HIV/AIDS epidemic over time. Second generation surveillance for HIV/AIDS also gathers information on risk behaviours, using them to warn of or explain changes in levels of infection.

Self-Reported Data: In research studies, self-reported data is a term applied to information that is directly reported by the study participants.

Sentinel Surveillance: A type of surveillance activity in which specific facilities, such as offices of certain health care providers, hospitals or clinics across a geographic region, are designated to collect data about a disease, such as HIV infection. These data are reported to a central database for analysis and interpretation.

Seroconversion: The root "sero" means the serum of the watery portion of blood. In HIV/AIDS research, seroconversion refers to the development of detectable antibodies to HIV in the blood as a result of HIV infection. A person who goes from being HIV negative to HIV positive is said to have seroconverted or is a seroconverter.

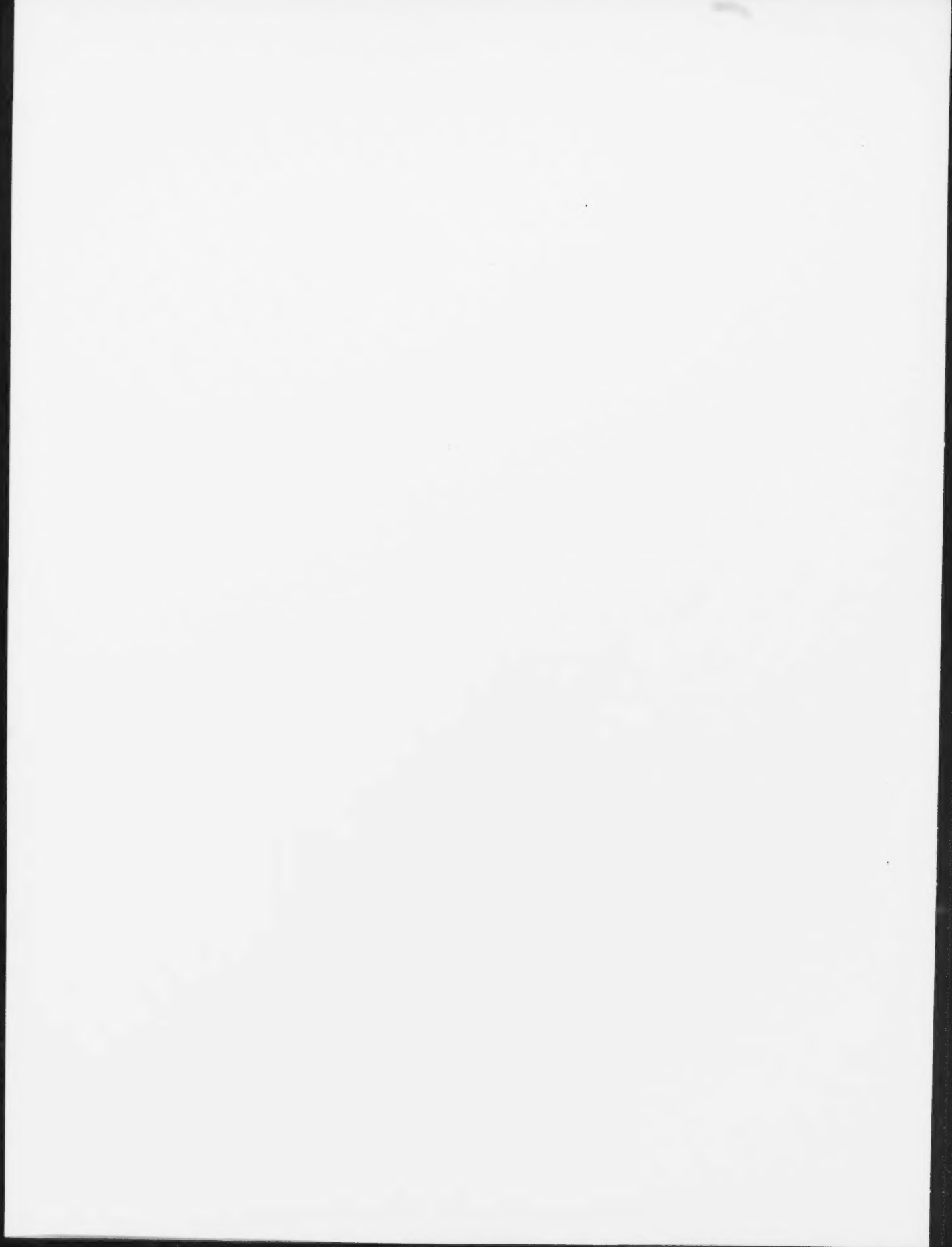
Serodiscordant: Relationships where one partner is infected with HIV and the other is not.

Seroprevalence: The term refers to the prevalence or prevalence rate of a disease as determined by testing blood rather than saliva, urine or sputum.

Street-involved: People who are engaged in street activities (such as illicit drug use, sex work, etc) that may increase their risk for HIV and STI transmission.

Surveillance: The ongoing collection, analysis and interpretation of data about a disease such as HIV or about a health condition. The objective of surveillance is to assess the health status of populations, detect changes in disease trends or changes in how the disease is distributed, define priorities, assist in the prevention and control of the disease, and monitor and evaluate related treatment and prevention programs.

Viral load: The viral load test is a quantitative measurement of HIV nucleic acid (RNA) that provides important information that is used (in conjunction with the CD4 cell count) to monitor the status of HIV disease, guide recommendations for therapy and predict the future course of the HIV infection/disease.





National HIV Prevalence and Incidence Estimates in Canada for 2008

At a Glance

- More Canadians are living with HIV infection: an estimated 65,000 at the end of 2008 compared with 57,000 at the end of 2005.
- An estimated 2,300 to 4,300 new HIV infections occurred in 2008 compared with 2,200 to 4,200 in 2005.

Introduction

This *Epi Update* outlines the estimates of the total number of Canadians who were living with HIV infection (including AIDS) at the end of 2008 (prevalence) and the number of new HIV infections in 2008 (incidence). Estimates published in this report for the years before 2008 replace all previous estimates that we have published concerning HIV prevalence and incidence in Canada, because new data and methods have permitted an improved analysis of the epidemic and more reliable estimates. National estimates of HIV prevalence and incidence are an integral part of the work carried out by the Centre for Communicable Diseases and Infection Control (CCDIC). They are used as a tool to monitor the HIV epidemic and to help evaluate and guide prevention efforts, and they are part of ongoing risk assessment and management work conducted by the Centre. These estimates inform the work that the Public Health Agency of Canada and other federal departments perform under the *Federal Initiative to Address HIV/AIDS in Canada* and will also be used to guide the activities of all stakeholders in their common efforts to support *Leading Together: Canada Takes Action on HIV/AIDS*.

Methods

Methods to estimate prevalence and incidence at the national level are complex and contain a level of uncertainty. We used multiple methods to estimate national HIV prevalence and incidence in 2008, including the workbook method,¹ an iterative spreadsheet model² and two statistical modelling methods.^{3,4} The workbook method multiplies an estimated prevalence or incidence rate by an estimated population size, the statistical models back-calculate estimates of HIV incidence by relating the timing of HIV positive testing with the timing of HIV infection and testing behaviour, and the iterative spreadsheet model incorporates elements of the other two methods.

These methods were used to generate separate estimates of HIV prevalence and incidence in Ontario, Quebec, British Columbia, Alberta, Saskatchewan, and Manitoba, which together account for over 93% of the population of Canada and over 98% of reported HIV and AIDS diagnoses.

Estimates in each province were classified according to the following exposure categories:

- men who have sex with men (MSM)
- people who inject drugs (IDU)
- MSM-IDU



- heterosexual/endemic (non-IDU heterosexual with origin in a country where heterosexual sex is the predominant mode of HIV transmission and HIV prevalence is high, primarily countries in sub-Saharan Africa and the Caribbean)⁵
- heterosexual/non-endemic (heterosexual contact with a person who is either HIV infected or at risk of HIV, or heterosexual as the only identified risk)
- other (recipients of blood transfusion or clotting factor, perinatal and occupational transmission).

(For more information on risk exposure categories and the classification hierarchy, please refer to Appendix 1 in the HIV and AIDS in Canada Surveillance Report to December 31, 2008, available at: http://www.phac-aspc.gc.ca/aids-sida/publication/survreport/2008/dec/surveillance_2008_13-eng.php#Section_5_a1.)

The results of the different methods were averaged to obtain prevalence and incidence estimates specific to exposure category for each of the six provinces. HIV prevalence and incidence estimates for the remainder of Canada were extrapolated from these six provinces using national HIV surveillance data. The national surveillance data were obtained from the national HIV and AIDS surveillance reporting system⁵ with enhancements from two sources: the Laboratory Enhancement Study in Ontario,⁶ which has more complete information on the exposure category of HIV cases, and recently published surveillance data⁷ from Quebec on exposure category breakdown of cases newly diagnosed with HIV during 2002 to 2008.

Bounds of uncertainty for the national HIV estimates were developed on the basis of a conservative consideration of results from a variety of scenarios. Estimates of HIV prevalence and incidence among women and Aboriginal people were derived from the overall estimates obtained from the distributions of reported sex and Aboriginal status, by exposure category, in the national HIV and AIDS surveillance data. The number of undiagnosed individuals living with HIV infection was computed as prevalence less cumulative HIV diagnoses, adjusted for under- and duplicate reporting and mortality.

Results

HIV prevalence in 2008

At the end of 2008, an estimated total of 65,000 (54,000-76,000) people in Canada were living with HIV infection (including AIDS), which represents an increase of about 14% from the 2005 estimate of 57,000 (47,000-67,000) (Table 1). In terms of exposure category, prevalent infections in 2008 comprised 31,330 MSM (48%), 11,180 IDU (17%), 10,710 heterosexual/non-endemic (17%), 9,250 heterosexual/endemic (14%), 2,030 MSM-IDU (3%), and 500 attributed to other exposures (1%) (Table 1). The largest absolute increase was in the MSM exposure category with 3,630 more prevalent infections since 2005 (13% increase). There were an estimated 1,660 more prevalent infections in the heterosexual/non-endemic exposure category (18% increase), 1,390 more in the heterosexual/endemic category (18% increase) and 1,080 more among IDU (11% increase).

Table 1. Estimated number of prevalent HIV infections in Canada and associated ranges of uncertainty at the end of 2008 and 2005 (point estimates, ranges and percentages are rounded)

	MSM	MSM-IDU	IDU	Heterosexual/ non-endemic	Heterosexual/ endemic	Other	Total
2008	31,330	2,030	11,180	10,710	9,250	500	65,000
	(25,400- 37,200)	(1,400- 2,700)	(9,000- 13,400)	(8,300- 13,100)	(6,800- 11,700)	(300-700)	(54,000- 76,000)
%	48%	3%	17%	17%	14%	1%	
2005	27,700	1,820	10,100	9,050	7,860	470	57,000
	(22,400- 33,000)	(1,200- 2,400)	(8,100- 12,100)	(7,000- 11,000)	(5,800- 9,900)	(280-660)	(47,000- 67,000)
%	48%	3%	18%	16%	14%	1%	

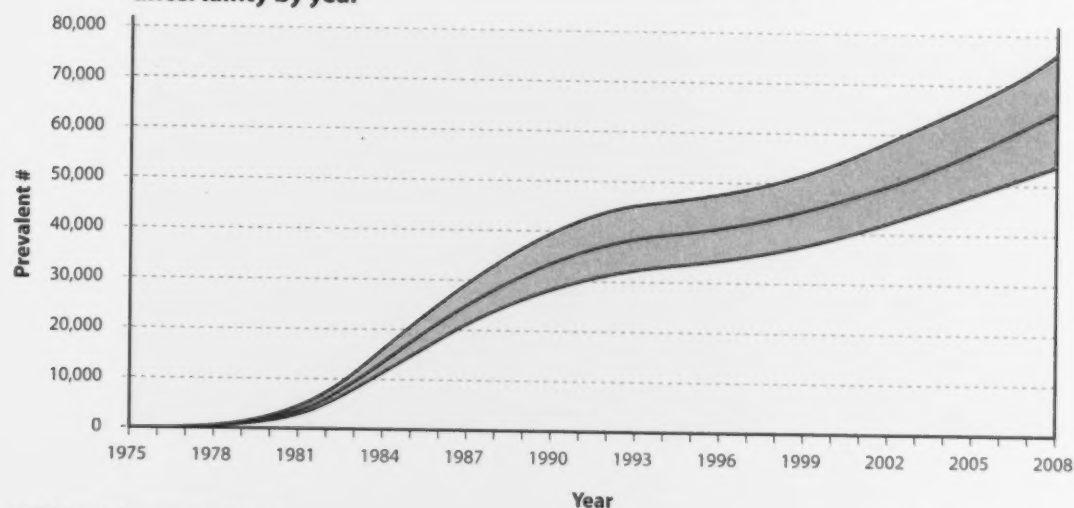
MSM: men who have sex with men; IDU: people who inject drugs; Heterosexual/non-endemic: heterosexual contact with a person who is either HIV infected or at risk of HIV or heterosexual contact as the only identified risk; Heterosexual/endemic: origin from a country where HIV is endemic; Other: recipients of blood transfusion or clotting factor, perinatal and occupational transmission

HIV prevalence: past trends

Prevalent infections (Figure 1) rose steadily during the 1980s, corresponding to the initial rise in HIV infection in the Canadian population, mainly among MSM. This rise slowed during the early to mid-1990s, likely as a result of both increased mortality and effective prevention

programs. Prevalent infections began to rise moderately in the late 1990s as a result of new treatments enabling individuals infected with HIV to live longer combined with continuing new infections.

Figure 1. Estimated number of prevalent HIV infections in Canada, including range of uncertainty by year



HIV incidence in 2008

The number of new infections in 2008 (estimated range between 2,300 and 4,300) was about the same as or slightly greater than the estimated range in 2005 (2,200 to 4,200) (Table 2). On examination of the estimates by exposure category, MSM continued to account for the greatest proportion of new infections (44%), which was only slightly lower than the estimated 45% in 2005,

although the range of new infections was the same (1,000 to 1,900) (Table 2). The new infections estimated among IDU increased from a range of 360 to 680 (16%) in 2005 to 390 to 750 (17%) in 2008. For the heterosexual/non-endemic exposure category, the range increased slightly from 440 to 820 in 2005 to 450 to 860 in 2008; however, the proportion (20%) was unchanged.

Table 2. Estimated ranges of uncertainty for number of incident HIV infections in Canada in 2008 and 2005 (ranges and percentages are rounded)

	MSM	MSM-IDU	IDU	Heterosexual/ non-endemic	Heterosexual/ endemic	Other*	Total
2008	1,000-1,900	50-130	390-750	450-860	370-690	< 20	2,300-4,300
%	44%	3%	17%	20%	16%		
2005	1,000-1,900	40-130	360-680	440-820	360-670	< 20	2,200-4,200
%	45%	3%	16%	20%	16%		

MSM: men who have sex with men; IDU: people who inject drugs; Heterosexual/non-endemic: heterosexual contact with a person who is either HIV infected or at risk of HIV or heterosexual contact as the only identified risk; Heterosexual/endemic: origin from a country where HIV is endemic; Other: recipients of blood transfusion or clotting factor, perinatal and occupational transmission

*New infections in the Other category are very few and are primarily due to perinatal transmission.

People from HIV-endemic countries continue to be over-represented in Canada's HIV epidemic. New infections attributed to the heterosexual/endemic exposure category increased slightly from a range of 360 to 670 in 2005 to 370 to 690 in 2008, although the proportion was unchanged (16%). Approximately 2.2% of the Canadian population were born in an HIV-endemic country according to the 2006 Census;⁸ therefore, the estimated new infection rate among individuals from HIV-endemic countries is at least 8.5 times higher than among other Canadians. With the current methods and available data, however, it is not

possible to differentiate infections acquired abroad from those acquired in Canada.

HIV incidence: past trends

Figure 2 presents the uncertainty range for estimated HIV incidence over time. New infections peaked during 1984-85, and this was primarily associated with the MSM population. The number of incident infections decreased steadily after 1985 until the mid-1990s, levelled off during 1996 to 1999, was followed by a slight increase during 1999 to 2002, and has levelled off again since 2002.

Figure 2. Estimated range of uncertainty (represented by vertical bars) in the number of new HIV infections in Canada for selected years

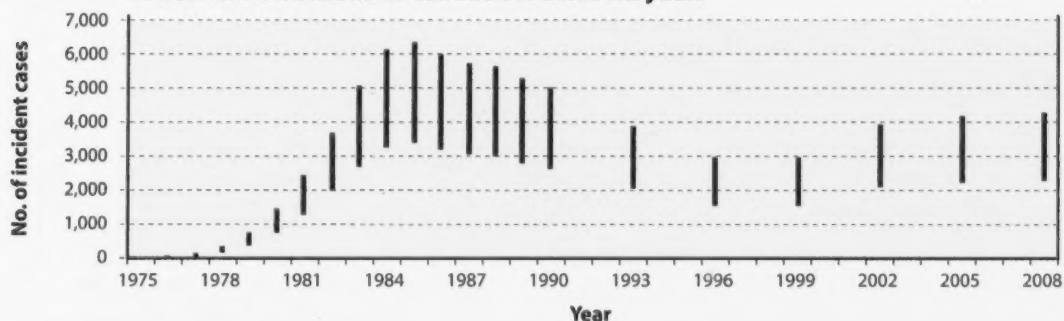
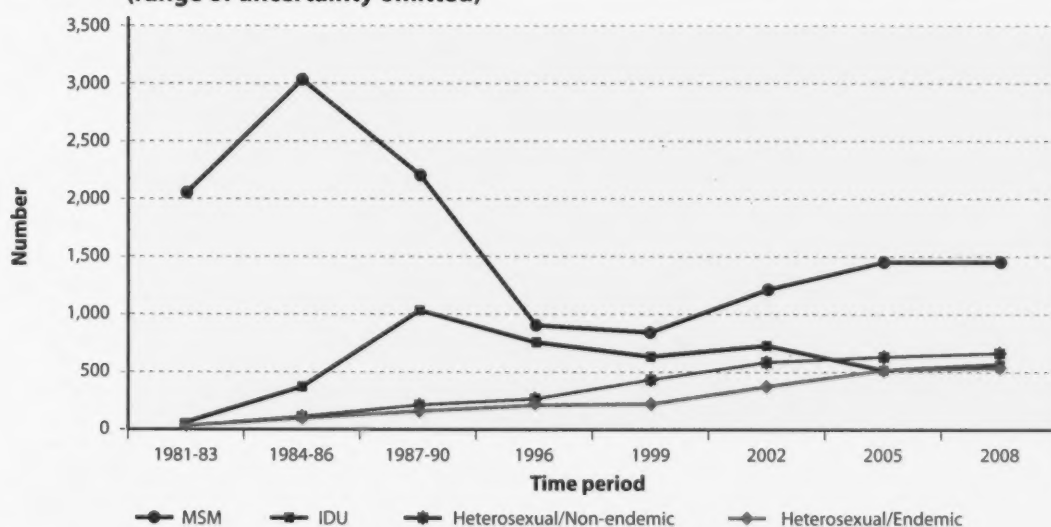


Figure 3 presents the estimated HIV incidence over time by exposure category. The number of incident infections among MSM reached a peak in 1984-86, decreased until 1999, and then increased before levelling off after 2005. The number of incident infections among IDU increased

to a peak during 1987-1990 and has shown a decreasing trend since then. The number of incident infections in both the heterosexual/non-endemic and heterosexual/endemic categories has increased gradually over time.

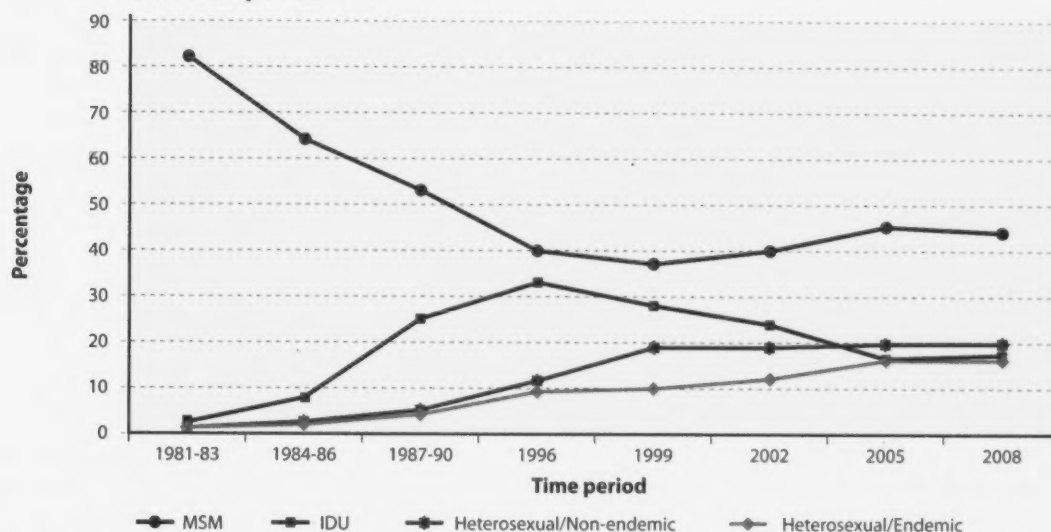
Figure 3. Estimated HIV incidence in Canada over time period by exposure category (range of uncertainty omitted)



The distribution of new HIV infections by exposure category has changed since the beginning of the HIV epidemic in Canada (Figure 4). At the early stage of the epidemic, almost all of the new infections (82%) were among MSM. In the mid-1990s, the majority of new infections occurred among MSM (40%) and IDU (33%),

and both the heterosexual/endemic and heterosexual/non-endemic categories accounted for around 10%. In 2008, the majority of new infections still occurred among MSM (44%), IDU accounted for 17%, heterosexual/endemic for 16%, and heterosexual/non-endemic for 20%.

Figure 4. Estimated exposure category distributions (%) of new HIV infections in Canada over time period



Trends among women

At the end of 2008, there were an estimated 14,300 (12,200-16,400) women living with HIV (including AIDS) in Canada, accounting for about 22% of the national total. This represents a 17% increase from the 12,200 (10,400-14,000) estimated for 2005. There were 600 to 1,120 new HIV infections among women in 2008, representing 26% of all new infections. For 2005, it was estimated that 590 to 1,100 new HIV infections occurred in women, accounting for about 26% of all new infections among women. With respect to exposure category, a slightly lower proportion of new infections among women was attributed to the heterosexual category in 2008 compared with 2005 (71% versus 73%), whereas a slightly higher proportion was attributed to IDU (29% in 2008 and 27% in 2005).

Trends among Aboriginal people

Aboriginal people continue to be over-represented in the HIV epidemic in Canada. An estimated 4,300 to 6,100 Aboriginal people were living with HIV in Canada in 2008, representing about 8.0% of all prevalent HIV infections. This is higher than the estimated 3,500 to 4,900 for

2005, which represented a slightly lower proportion (7.4%) of the epidemic. An estimated 300 to 520 new HIV infections occurred in Aboriginal people in 2008 (12.5% of all new infections). This is higher than the estimated 240 to 430 infections (10.5%) that occurred in 2005. Aboriginal people represented 3.8% of the Canadian population according to the 2006 Census.⁸ Therefore, the overall new infection rate among Aboriginal people is about 3.6 times higher than among non-Aboriginal people in 2008. The distribution of new infections in Aboriginal people by exposure category in 2008 was 66% among IDU, 23% among heterosexual, 9% among MSM, and 2% among MSM-IDU; the corresponding figures in 2005 were 63% among IDU, 24% among heterosexual, 11% among MSM, and 2% among MSM-IDU.

The proportion of new HIV infections in 2008 attributed to IDU was much higher among Aboriginal Canadians (66%) than among all Canadians (17%). This highlights the uniqueness of the HIV epidemic among Aboriginal people and underscores the complexity of Canada's HIV epidemic.

Undiagnosed HIV infections: the hidden epidemic

There have been 67,442 positive HIV tests reported to CCDIC since testing began in November 1985 up to December 31, 2008, which translates to about 70,400 after adjusting for underreporting and duplicates. Of these, we further estimate that approximately 22,300 have died. Thus, there were an estimated 48,100 (70,400 minus 22,300) Canadians living with HIV infection in 2008 who had been given a diagnosis of HIV (tested positive) and are therefore aware of their HIV status. Since there was an estimated total of 65,000 people living with HIV in Canada in 2008, the remaining 16,900 (range of 12,800-21,000) people, or 26% of prevalent cases, are unaware of their HIV infection. This figure is slightly less than the estimate of 27% of people who were unaware of their HIV status in 2005.

The estimated percentage of people living with HIV in 2008 who were unaware of their HIV status varies by exposure category. Approximately 19% of infected people in the MSM exposure category and 25% of infected people in the IDU exposure category were unaware of their HIV infection, whereas there was a much higher proportion (35%) in the two heterosexual exposure categories. These percentages correspond to an estimated 6,000 (4,500-7,500) people infected with HIV in the MSM exposure category, 2,800 (2,000-3,600) people infected with HIV in the IDU exposure category, and 7,000 (5,200-8,800) people infected with HIV in the combined heterosexual exposure category who were unaware of their HIV-positive status.

Discussion

Approximately 65,000 Canadians were estimated to be living with HIV infection at the end of 2008. This number will likely increase as new infections continue and survival improves as a result of new treatments, and this will mean increased future care requirements. The estimated number of new infections occurring in Canada in 2008 was about the same as or slightly greater than the estimated number for 2005. However, the range (2,300 to 4,300) for 2008 is very similar to the range for 2005 (2,200 to 4,200), and a more firm conclusion is that overall incidence is not decreasing.

Incidence in the IDU exposure category appears to be increasing slightly compared with the 2005 estimates. However, the HIV epidemic in this group shows different trends in different jurisdictions in Canada. In the majority of jurisdictions, the rates of reported newly diagnosed cases of HIV infection among IDU are stable or declining,⁵ which is consistent with the trend in most high-

income countries. The role of injecting drug use in national epidemics in Europe and the United States has dramatically declined over the course of the epidemic.⁹ In contrast, injecting drug use is the main HIV exposure category among Aboriginal persons in Canada, and this overlap group (persons who are both Aboriginal and who inject drugs) accounts for the majority of the increasing number of new diagnoses of HIV infection reported in the province of Saskatchewan.⁵

We found that HIV incidence among MSM increased between 1999 and 2005 but levelled off from 2005 to 2008. The re-emergence of the epidemic between 2000 and 2005 among MSM is clearly apparent in many high-income countries.⁹⁻¹¹ Heterosexual HIV transmission (combined heterosexual/non-endemic and heterosexual/endemic) accounted for 36% of newly infected cases in Canada in 2008, which was in line with trends in Western Europe (29%)⁹ and very similar to the epidemic in the United States (slightly more than one in three new HIV infections).^{9,12}

A combination of methods was used during the estimation process in Canada, and a wide variety of data sources were included. However, the amount of data available was not always sufficient for the modelling to estimate exposure category numbers for all provinces. Several other limitations also need to be acknowledged. Estimates for the Aboriginal subpopulation relied on ethnic variables in the HIV and AIDS surveillance data that are not consistently reported at the national level. Information on risk factors in surveillance data was also incomplete, and this may have led to the misclassification of some cases. Furthermore, insufficient information was available to distinguish infections acquired outside Canada from those acquired within. Therefore, incidence as used in this report refers to a new infection appearing in Canada, either through transmission within Canada or the arrival of an HIV-positive individual from another country. CCDIC is currently working with its partners to obtain data that would allow for the separate modelling of domestically acquired infections and the subsequent addition of newly arrived infections to these estimates. Despite the limitations noted, we believe that these results portray a plausible picture of the epidemic in Canada at the end of 2008 and provide a robust foundation to guide the development of HIV/AIDS programs.

These national estimates do not necessarily reflect local trends in HIV prevalence and incidence. For example, we found that new HIV diagnoses in the IDU exposure category are stable or declining in the majority of jurisdictions; while a substantial increase in recent years has been seen in the province of Saskatchewan.⁵ Overall estimates may mask trends in subpopulations as well.

The estimates do not address all populations affected by the HIV/AIDS epidemic in Canada (such as prisoners), and the estimates are not stratified by age.

Aboriginal people and people from HIV-endemic countries continue to be over-represented in Canada's HIV epidemic. These findings highlight the need for specific measures to address the unique aspects of the HIV epidemic within certain subpopulations. For example, IDU is the main HIV exposure category among Aboriginal people, whereas heterosexual activity is the main risk for women and those from HIV-endemic countries. There also continues to be a sizeable number of people living with but unaware of their HIV infection. Until these people are tested and diagnosed, they are unable to take advantage of appropriate care and treatment services or to receive counselling to prevent further spread of HIV.

To successfully control the HIV epidemic in Canada, more effective strategies are needed to prevent new infections and provide services for all of the key populations identified in the *Federal Initiative to Address HIV/AIDS in Canada*. In addition, there is an increasing need to improve the availability and quality of data to better understand and monitor the full scope of the HIV epidemic in Canada.

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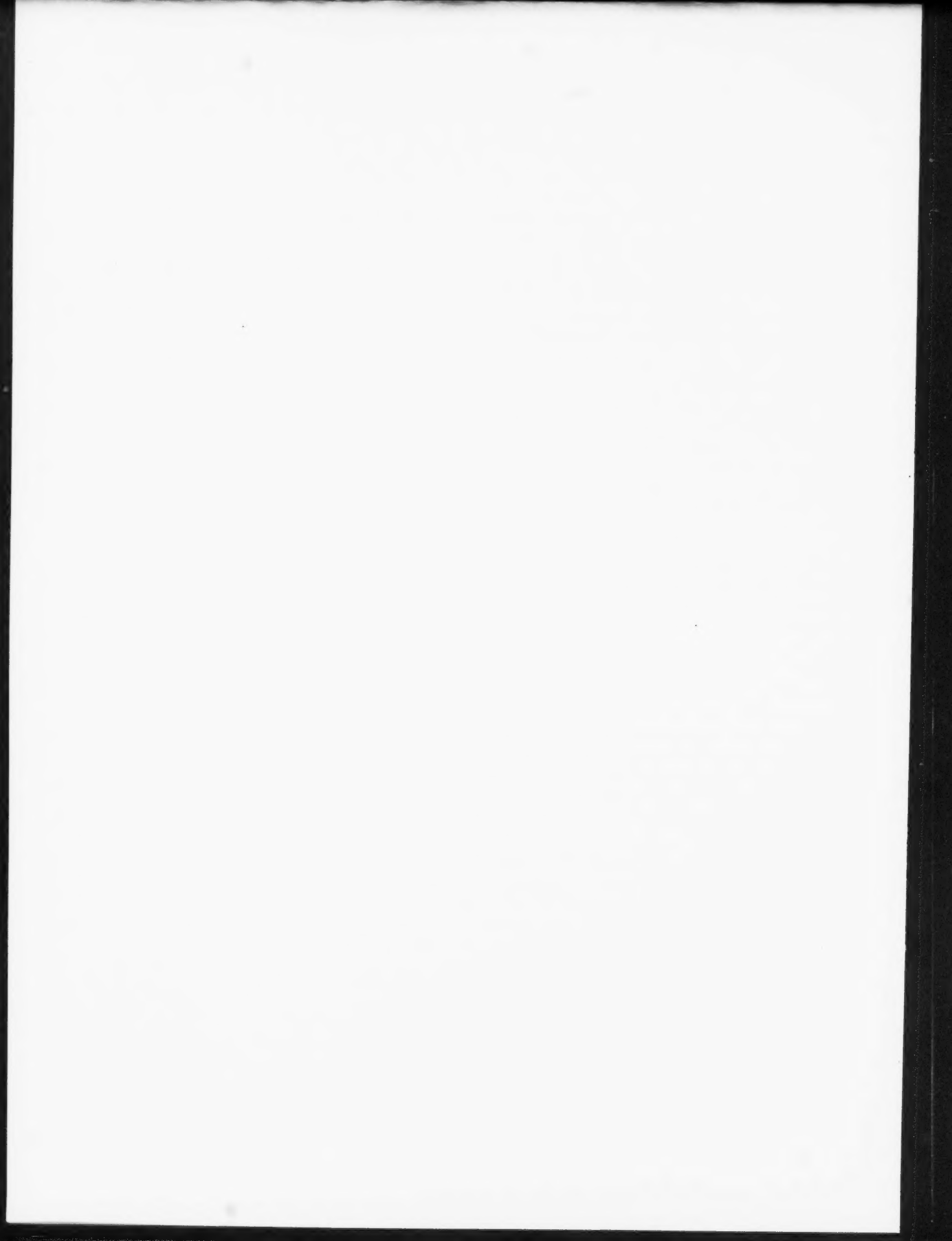
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Undiagnosed HIV Infections in Canada

At a Glance

- At the end of 2008, an estimated 65,000 people were living with HIV (including AIDS) in Canada.
- Of these, approximately 16,900, or 26%, were not aware of their infection.
- Given the new treatments available for HIV, it is more important than ever that all Canadians should be able to access HIV testing.

Introduction

This *Epi Update* presents information on the estimated number of Canadians who were HIV infected but unaware of their infection at the end of 2008. It also summarizes available data on the characteristics of people tested for HIV in Canada.

HIV Infected But Unaware in Canada

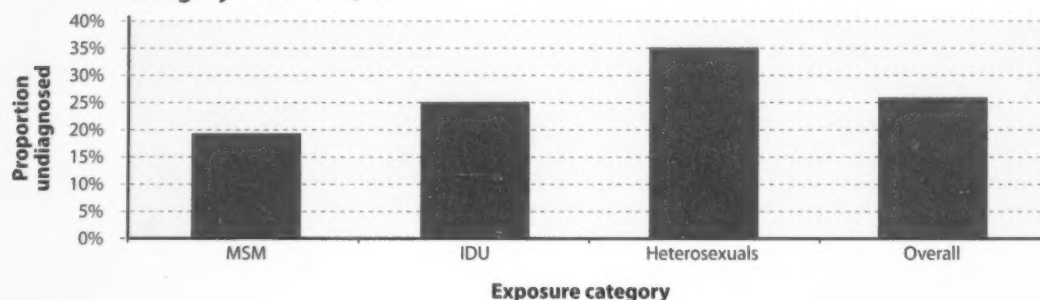
It is important to note that data on positive HIV tests represent only those who have tested positive for HIV infection and do not represent everyone who has been infected with HIV, as some who have been infected have not yet accessed testing. The Centre for Communicable Diseases and Infection Control (CCDIC) recently published estimates of HIV prevalence in Canada to the end of 2008 (for details, please see Chapter 1 of this *Epi Update* series, entitled "National HIV Prevalence and Incidence Estimates in Canada for 2008").

It was estimated that approximately 65,000 (54,000-76,000) Canadians were living with HIV infection (including those living with AIDS) at the end of 2008. This number includes those who were aware of their infection (had had a positive HIV test) and those who were unaware of their infection (had not been tested for HIV yet or had not known their testing result). There have been 67,442 positive HIV tests reported to CCDIC since testing began in November 1985 to December 31, 2008, which translates to about 70,400 after adjusting for underreporting and duplicates. Of these, we further estimated that approximately 22,300 have died. Thus, there were an estimated 48,100 (70,400 minus 22,300) Canadians living with HIV infection in 2008 who had been given a diagnosis of HIV (tested positive) and were therefore aware of their HIV status. Since an estimated total of 65,000 people were living with HIV in Canada in 2008, the remaining 16,900 (range of 12,800-21,000), or 26% of prevalent cases, were unaware of their HIV infection. This figure is slightly less than the estimate of 27% who were unaware of their HIV status in 2005.

The estimated percentage of people living with HIV who are unaware of their HIV status varies by exposure category. Approximately 19% of infected people in the MSM (men who have had sex with men) exposure category and 25% of those in the IDU (people who inject drugs) exposure category are unaware of their HIV infection. By comparison, there is a much higher proportion of individuals (35%) who are unaware in the combined heterosexual exposure category (Figure 1). These percentages correspond to an estimated 6,000 (4,500-7,500) MSM, 2,800 (2,000-3,600) IDU and 7,000 (5,200-8,800) people in the combined heterosexual exposure category who were unaware of their HIV-positive status at the end of 2008.



Figure 1. Estimated proportion of people with undiagnosed HIV infection by exposure category in Canada, 2008



A more direct measure of the proportion of people in certain subpopulations who are HIV infected but unaware of their infection is available through the national, second-generation HIV surveillance systems. This is possible by comparison of self-reported HIV status (by questionnaire) with HIV serostatus, measured by the biological specimen obtained from participants. Using this methodology, the "unaware" individuals were survey participants who reported that they had never been tested for HIV or that their HIV status was negative or unknown, whereas HIV testing performed on their biological specimens indicated that they were HIV positive. In the I-Track, the surveillance system focused on people who inject drugs, the overall proportion of participants with HIV-positive specimens who were unaware of their positive status was 22.3% in Phase 1 (sentinel site range: 11.1% to 50.0%, surveys conducted in 2003-2005) and 21.0% in Phase 2 (sentinel site range: 0.0% to 43.5%, surveys conducted in 2005 to 2008). In the M-Track, the surveillance system focused on gay, bisexual and other MSM, the overall proportion of HIV infected participants who were unaware of their HIV positive status was 19.1% (sentinel site range: 12.5% to 23.2%).

For more details on the "Track" second-generation HIV surveillance systems, see Chapter 3 of these *Epi Updates*, "HIV Testing and Surveillance Systems". Chapter 9, "HIV/AIDS among Gay, Bisexual and other Men who have sex with Men (MSM) in Canada", provides more information on the epidemiology of HIV and AIDS among MSM, and Chapter 10, "HIV/AIDS among People Who Inject Drugs in Canada", provides information on HIV infection among IDU.

Comparisons of Proportion Undiagnosed in Other Developed Countries

Despite the widespread availability of antiretroviral treatment and extensive promotion of HIV testing, an estimated 26% of HIV infections remained undiagnosed in Canada in 2008. The situation is very similar in other high-income countries. For example, the percentage of HIV-positive people without a diagnosis was estimated to be 21% in the United States in 2006,¹ 30% in the European Union in 2008² and 27% in the United Kingdom in 2008.³ We estimated that among MSM in Canada, 19% of people living with HIV were unaware of their HIV positive status, which is comparable with a recent report (20%) from Australia,⁴ slightly lower than the rates estimated in the US (23.5%)⁵ and the UK (26.9%)³, and much lower than the rate from a survey in Scotland (41.7%).⁶ We estimated that among IDU in Canada, 25% of people living with HIV were unaware of their HIV status, which is very similar to recent estimates in the UK (25.5%)³ but higher than estimates in the US (14.5% of male IDUs and 13.7% of female IDUs).⁵ Our estimate of 35% in the heterosexual exposure category is slightly higher than the rate estimated in the UK (27.1%)³ and the US (26.7% of men and 21.1% of women).⁵

HIV Testing and Reporting in Canada

HIV testing first became available in Canada in 1985. Since then, individuals have had the opportunity to access HIV testing services through either nominal or non-nominal testing at a doctor's office or clinic, or through anonymous testing sites available in some provinces. At present, nominal/name-based and non-nominal/non-identifying HIV testing methods are widely available in Canada; however, anonymous HIV testing is available in only seven provinces (for details, please see Chapter 3, entitled "HIV Testing and Surveillance Systems").

Characteristics of Persons Tested for HIV

There has been no new Canada-wide survey available regarding HIV testing behaviour since 2003. A Canada-wide survey conducted in March 2003 of randomly selected individuals above 15 years of age revealed that just over one-quarter (27%, 29% of men and 24% of women) reported ever having been tested for HIV, excluding testing for the purposes of insurance, blood donation and participation in research.⁷ The figures from this 2003 survey show that a higher proportion of individuals reported having been tested than in a January 1997 Canada-wide survey, which found a corresponding figure of 18.6% of men and 16.2% of women aged 15 years and older (excluding tests for blood donation and insurance purposes).^{8,9} However, the proportion of people who had been tested in the previous 2 years did not increase (42% in 2003 and 57% in 1997). The results of a 1996 survey showed that, taking into account ancillary testing such as for blood donation or life insurance purposes, 41% of men and 31% of women in Canada had ever been tested for HIV.¹⁰

National surveys and studies of the general population suggest that those who report risk factors are more likely to be tested:

- Among heterosexuals, those with two or more partners in the previous year were more likely to be tested than those with one partner (50.5% versus 17.4%). The percentage of Canadians being tested was higher among individuals who reported casual partners (45%); this percentage increased with the number of partners, from 30% among those reporting one partner to 41% among those reporting two partners and 51% among those reporting three partners.⁷ Of individuals who reported having had a sexually transmitted infection (STI) in the previous 5 years, 58% had been tested compared with 17.4% of those who did not report an STI.^{8,9}
- For men, the testing rate was higher among MSM (71%), IDU (62%), those who had received blood or clotting factor between 1978 and 1985 (27%) and those who had had a partner with a risk factor (IDU, received blood or clotting factor between 1978 and 1985 or came from a country endemic for HIV) (30%).^{8,9} For women, testing was higher among those who had received blood or clotting factor between 1978 and 1985 (32%) and those who had had a high-risk partner (38%).¹⁰
- Testing was highest among individuals aged 25 to 34 years. Even after all other risk factors had been taken into account, those aged 45 years and over were still less likely to be tested than those younger than 45 years.⁸⁻¹⁰ In the survey conducted in March 2003, Canadians aged 25-34 years and 35-44 years were more likely to have been tested (46% and 35% respectively).⁷
- Although national surveys have found that those reporting risk factors such as use of intravenous drugs, sex between men, or having multiple sex partners are more likely to be tested, a substantial proportion of individuals reporting risk factors have not been tested recently or have not been tested at all. For example, in a 1997 national survey, among those who reported having had more than one partner in the previous year and not having used condoms consistently, 53% of men and 38% of women had never been tested.^{7,8}
- Targeted studies have shown that a large proportion of individuals in higher-risk populations have been tested for HIV. The proportion who reported ever having been tested was 86.2% among M-Track participants in Phase 1 (2005-2007)¹¹ and 91.9% among I-Track participants in Phase 2 during 2005-2008.¹² An Ontario study of Black MSM between 2007 and 2008 showed that 144 men (85.7%) had previously been tested for HIV.¹³ These rates are much higher than the 63% of MSM respondents in a national study in 1991 who indicated that they had been tested for HIV¹⁴ and slightly higher than the 78% of MSM who responded in the Ontario Men's Survey in Ontario in 2002.¹⁵
- However, a national study involving Canadian Aboriginal youth found that 51% (210 of 413) had ever been tested for HIV;¹⁶ in a study of Quebecers of Haitian origin (2007-2008), 43.1% of the study participants reported ever having been tested for HIV;¹⁷ and the proportions that reported having been tested within the previous two years were 67.4% of M-Track participants in Phase 1 (among those who reported that their most recent HIV test result was negative)¹¹ and 63.9% of I-Track participants in Phase 2.¹²
- There are several factors that may relate to low uptake of HIV testing. In M-Track Phase 1 (2005-2007), young age, low personal income, never having injected drugs and no sex in the previous 6 months were related to lower odds of HIV testing.¹¹ In I-Track Phase 2 (2005-2008), less frequent injecting, less use of needle exchange programs, Aboriginal ethnicity, young age and less education were all factors related to lower

rates of HIV testing.¹²

Comment

It has been estimated that approximately 16,900 people or 26% of the HIV-infected population were unaware that they were infected at the end of 2008. The size of the undiagnosed group is especially difficult to estimate because, without testing, those individuals are "hidden" to the health care and disease monitoring systems. It is important to reach this group since individuals whose infection has not been diagnosed are unable to take advantage of available treatment strategies or appropriate counselling to prevent the further spread of HIV. The transmission rate in the undiagnosed group is likely higher than that of the tested and diagnosed group.¹⁸ Studies have found that the frequency of high-risk sexual behaviour was reduced substantially after HIV diagnosis.¹⁹ To help stem the HIV/AIDS epidemic, it is important to increase the number and proportion of people living with HIV who receive testing and are informed of their serostatus.¹⁸

HIV testing is important not only for prevention and control measures but also for the benefit of the individuals who are tested. Knowledge of one's HIV status can be useful for several reasons. Counselling received at the time of HIV testing can provide critical information about how to reduce the risk of HIV infection if an individual is HIV negative. If an individual is found to be HIV infected, consideration can be given to starting antiretroviral therapy. In the case of pregnant women, treatment can

reduce the chances that the infant will be infected, from 35%-40% to 2% or less.²⁰

People at high risk of HIV (such as MSM or IDU) more frequently test for HIV, but scaled-up and targeted promotion of HIV testing is still needed in certain subpopulations that access testing less frequently (such as younger individuals and those with lower income and lower education levels). In order to better inform interventions, further information is needed about individuals who are at risk of HIV but have not been tested. Given the findings to date and the fact that new treatments are available for HIV infection, it is more important than ever that all Canadians, particu-

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larly those at highest risk of infection, should be able to access HIV testing.

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HIV Testing and Surveillance Systems in Canada

At a Glance

- Nominal, non-nominal and anonymous HIV testing are available in Canada.
- HIV infection is notifiable in all provinces and territories in Canada.
- Two types of surveillance systems monitor HIV trends in Canada; routine, case-based reporting of HIV & AIDS, and second generation surveillance of key populations.

Introduction

Surveillance is a crucial component in the coordinated response to HIV/AIDS. It allows for a better understanding and identification of trends in the epidemic, which in turn help to inform and increase the efficacy of prevention, treatment and care interventions. Surveillance activities also allow Canada to continue to regularly report on the country's progress on HIV and AIDS indicators, which is an obligation for all member states that signed the United Nations' 2001 Declaration of Commitment on HIV/AIDS.

This *Epi Update* chapter provides an overview of Canada's HIV/AIDS surveillance systems, both routine and enhanced surveillance, and includes information on the types of HIV testing available across the country and the different reporting and data collection methods.

HIV Testing in Canada

Information about HIV testing patterns in the general population, along with information on the profile of people being tested, is important for designing and targeting intervention programs.¹ In 2006, a general population survey of 2,036 Canadians over the age of 15 showed that 32% of respondents had ever been tested for HIV, a slight increase from 27% in 2003.²

Canadians who want to be tested for HIV have up to three different testing options, depending on the province or territory in which the testing takes place: **nominal**, **non-nominal** or **anonymous**. At present, nominal/name-based and non-nominal/non-identifying HIV testing are widely available in Canada; however, anonymous HIV testing is available in only seven provinces.

Nominal/name-based HIV testing

- May be carried out at numerous locations, including clinics and offices of health care providers.
- The health care practitioner ordering the test knows the identity* of the person being tested for HIV.
- The HIV test is ordered using the name of the person being tested.
- Patient information is collected, such as age, sex, city of residence, name of diagnosing health care provider, country of birth, ethnicity, information detailing the HIV-related risk factors of the person being tested and laboratory data. The amount of information collected varies according to the province/territory.
- If the HIV test result is positive, the health care practitioner ordering the test is obligated by law to notify public health officials (within the respective jurisdiction) of the positive test result.

* In rare instances, the true identity of the person being tested for HIV may not be known.

- The test result is recorded in the health care record of the person being tested.

Non-nominal/non-identifying HIV testing

- Similar to nominal/name-based testing with one exception: the HIV test is ordered using a code or the initials of the person being tested (not including the full or partial name).

Anonymous testing

- Usually available at specialized clinics, organized and supported by public health departments and by some health care providers.
- The health care provider ordering the HIV test does not know the identity of the person being tested for HIV.
- The HIV test is carried out using a code. The health care provider ordering the HIV test and the laboratory

carrying out the testing on the blood sample do not know to whom the code belongs.

- Information such as age, sex, HIV-related risk factors and the ethnicity of the person being tested for HIV may be collected during anonymous testing, depending on the province or territory in which the test is ordered or on the test site.
- Test results are not recorded on the health care record of the person being tested. It is only the person being tested who may subsequently decide to give his or her name and include the HIV test result in the medical record.

Table 1 provides information on the availability of different types of testing as well as reporting protocols within each province/territory.

Table 1. Type of HIV testing and reporting protocol by province/territory

Province/territory	Type of HIV testing available	Year in which HIV infection became notifiable	Responsibility for reporting of HIV infection
British Columbia	N, NN*	2003	L, P**
Yukon	N, NN	1995	L, P, RN
Northwest Territories	N, NN	1988	L, P, RN
Nunavut	N, NN	1999	L, P, RN
Alberta	N, NN, A†	1998	L, P, NP
Saskatchewan	N, NN, A	1984	L, P, RN
Manitoba	N, NN, A	1985	L, P
Ontario	N, NN, A	1985	L, P, RN, MW
Quebec	N, NN, A	2002	L, P
New Brunswick	N, NN, A	1985	L, P, RN
Nova Scotia	N, NN, A	1985	L, P
Prince Edward Island	N, NN	1988	L, P, RN
Newfoundland and Labrador	N, NN, A†	1987	L, P, RN

N: nominal/name-based; NN: non-nominal/non-identifying; L: laboratory; P: physician; RN: registered nurse; NP: nurse practitioner; A: anonymous; MW: midwife

* In BC, reports of non-nominal tests to public health do not include identifying information

** In BC, all positive cases are reported to HIV Surveillance/British Columbia Centre for Disease Control, which then reports the first positive cases to designated nurses in the health service delivery area where the test was ordered.

† If someone tests positive for HIV through anonymous testing (AHT), that individual then becomes part of the nominal/name-based system, in which counselling, follow-up care and HIV data reporting are all done nominally.

Availability of Anonymous HIV Testing (AHT) May Increase Testing

As AHT offers the highest degree of confidentiality, it may encourage more people to come forward for HIV testing and counselling.³ Several studies in the United States have shown that AHT programs encourage people to be tested for HIV infection, especially those at high

risk or those who would not volunteer for testing under nominal/name-based or non-nominal/non-identifying circumstances.^{4,6} In Ontario, from 1992 through the end of 2007, more than 160,000 HIV tests were performed anonymously, accounting for 3.3% of all tests conducted in the province during that period.⁷

Information regarding the status of anonymous HIV testing in Canada is summarized in Table 2.

Table 2. Status of anonymous HIV testing (AHT) by province/territory

Province/territory	Year in which AHT became available	AHT sites	AHT data reported to CCDIC
British Columbia	n/a	n/a	n/a
Yukon	n/a	n/a	n/a
Northwest Territories	n/a	n/a	n/a
Nunavut	n/a	n/a	n/a
Alberta	1992	3	yes*
Saskatchewan	1993	3**	no
Manitoba	2007	2	yes
Ontario	1992	50	yes
Quebec	1987	60+	no
New Brunswick	1998	7 [†]	yes
Nova Scotia	1994	3	no
Prince Edward Island	n/a	n/a	n/a
Newfoundland and Labrador ^{††}	n/a	12	yes*

CCDIC: Centre for Communicable Diseases and Infection Control

* If someone tests positive for HIV infection through anonymous HIV testing (AHT), that individual then becomes part of the nominal/name-based system, in which counselling, follow-up care, and HIV data reporting are all done nominally.

** AHT is also available at other sexual health clinics upon request.

[†] Additional testing sites available in federal/provincial correctional facilities.

^{††} AHT is available upon request but is not part of the official guidelines for the province.

HIV Infection is Notifiable Across Canada

By 2003, positive HIV test results and AIDS diagnoses had been designated as notifiable* in all Canadian provinces and territories. In most testing situations, laboratories and physicians are responsible for reporting HIV infection, but this varies by province or territory. When an individual tests positive for HIV infection for the first time, nominal/name-based or non-nominal/non-identifying information is forwarded to provincial or territorial public

health officials. This includes demographic data, such as the person's age and sex, risks associated with the transmission of HIV, and laboratory data, such as the date of the person's first positive HIV test. Although HIV infection is not legally notifiable at the national level, notification to PHAC is voluntarily undertaken by all provinces and territories. Positive HIV test reports and reported AIDS cases are provided non-nominally to PHAC. This facilitates the production of national level reports on the state of HIV/AIDS epidemiology in Canada.

* A notifiable disease is one that is considered to be of such importance to public health that its occurrence is required to be reported to public health authorities. (The terms "notifiable" and "reportable" are used interchangeably when discussing HIV/AIDS reporting in Canada.)

HIV Surveillance

There are two types of HIV surveillance systems in Canada. Routine HIV/AIDS case surveillance, which is also known as first-generation surveillance, involves the collection of case reports of HIV and AIDS diagnoses. Enhanced surveillance, also known as second-generation surveillance, entails gathering behavioural information, such as sexual, injecting and testing behaviours in a targeted group of people, in addition to information on each individual's infection status.

Routine surveillance of HIV and AIDS

Reporting and its limitations

There were 21,300 AIDS cases reported to the Public Health Agency of Canada (PHAC) between 1979 and December 31, 2008, and 67,442 positive HIV tests reported between 1985 and the end of December 2008.⁸ The positive HIV test results reported to PHAC are from people who test positive for HIV through nominal, non-nominal or anonymous testing in the provinces and territories and whose results are reported to PHAC by their respective health authority or HIV testing laboratory. An AIDS case report is made when an individual is first given a diagnosis of AIDS by his/her health care provider. For reports on both HIV-positive test results and AIDS diagnoses, the data sent to PHAC do not contain names or individual cases.

It should be mentioned that routine surveillance has significant limitations. Most importantly, it can only capture those individuals who have been tested for HIV and/or been given a diagnosis of an AIDS defining-illness, so the figures presented here do not capture those people living with HIV/AIDS who are unaware that they are infected with HIV. Routine surveillance also has limitations with regard to underreporting, delayed reporting, potential duplicate reporting and reporting of ethnicity status, although these limitations are reduced as much as possible, and caution is exercised when interpreting the data.

Exposure category hierarchy

HIV and AIDS cases are assigned to a single exposure category according to a hierarchy of risk factors. If more than one risk factor is reported, a case is classified as the exposure category listed first (or highest) in the hierarchy. For example, people who inject drugs (IDU) may also be at risk of HIV infection through heterosexual activity. Injecting drug use is accepted as the higher risk activity even though there may also be a risk of HIV infection through sexual activity. The only exception to this is men who report having had sex with men (MSM) and to have also injected drugs. Such cases are classified in the combined exposure category MSM/IDU. For specific details on the different exposure categories, please refer to PHAC's HIV and AIDS Surveillance Reports (accessible at: <http://www.phac-aspc.gc.ca/aids-sida/publication/index-eng.php#surveillance>).

Comments

Increased availability of and accessibility to different types of HIV testing may allow individuals to choose the testing and counselling environment in which they feel most comfortable, thereby encouraging more people to be tested and facilitating the targeting of intervention and treatment programs. PHAC is currently engaged in the development of Comprehensive Guidelines for HIV Testing in Canada, which will provide direction on test planning approaches aiming to increase opportunities for HIV testing among people at risk of HIV infection. The collection of data on positive HIV tests and AIDS diagnoses at both the provincial and national levels allows for monitoring of the epidemics in Canada, which helps to inform programs and policy. However, while routine surveillance provides some data on HIV exposure categories, it provides no information on the specific behaviours that put these groups at risk.

Biological and behavioural surveillance

Background

The *Federal Initiative to Address HIV/AIDS in Canada* identified a need to develop discrete approaches to addressing the epidemic in key populations in Canada. Key populations identified include, but are not limited to, people who inject drugs (IDU); gay, bisexual and other MSM; people from countries where HIV is endemic; women; youth; Aboriginal peoples; prison inmates; and people living with HIV/AIDS.

In line with recommended approaches advocated by the World Health Organization and the Joint United Nations Programme on HIV/AIDS, and as part of the *Federal Initiative to Address HIV/AIDS in Canada*, PHAC monitors trends in HIV prevalence and associated risk behaviours in key populations identified in Canada through second-generation HIV surveillance systems. These surveillance systems are known as the "Track" systems. To date, PHAC has developed and implemented second-generation HIV surveillance systems that focus on IDU and on gay, bisexual, and other men who have sex with men, respectively called the I-Track and the M-Track systems. The E-Track concept, which has a focus on people who originate from countries where HIV is endemic* or those from specific ethnocultural populations, has been successfully piloted in Quebec and is being further developed. Currently under development are two additional "Track" systems: the A-Track (focus on Aboriginal peoples) and the P-Track (focus on persons with HIV infection).

The overall objectives of the I-, M-, E- and A-Track systems are to describe the changing patterns in the prevalence of HIV infections and possibly also incidence, as well as risk behaviour practices and the testing patterns for HIV, hepatitis C and other sexually transmitted and bloodborne infections (STBBIs) in each respective population. The P-Track is envisioned to monitor trends in access to and uptake of care and treatment services.

Methods

The Track systems monitor HIV and associated risk behaviours in Canada by combining behavioural and biological surveillance, and are conducted through periodic, cross-sectional surveys administered at selected urban/semi-urban sites across Canada. Core generic protocols and questionnaires designed to meet the needs of local/provincial and national levels are developed in consultation with research experts in the field and with populations of interest. At the national level, the results enable generation of national level indicators and reporting on international indicators. Protocols and questionnaires are reviewed by the Health Canada/Public Health Agency of Canada research ethics boards (REBs) as well as local REBs for each site.

Participants are primarily recruited using venue-based sampling methods, and participation is voluntary, completely anonymous and requires informed consent. Respondents are limited to participating once during each survey round across all of the sentinel surveillance sites. Information on demographic characteristics, sexual behaviours, drug use, testing for HIV, hepatitis and other STBBIs, and attitudes towards HIV is collected through a self- or interviewer-administered national core questionnaire. Sentinel sites have the option of adding additional site-specific questions to address local needs. A biological specimen, either a finger-prick blood sample or oral fluid sample, is collected; these specimens are tested for antibodies against HIV and hepatitis C virus. Depending on sentinel site prioritization, specimen availability and test validity, specimens may also be tested for syphilis and other STBBIs.

The Track surveys are planned and implemented in partnership with site investigators, local study teams (composed of representatives from local/provincial public health authorities), community advisory committees and other stakeholders.

* List of HIV endemic countries: http://www.phac-aspc.gc.ca/publicat/epiu-aepi/epi-1205/app_a-eng.php

I-Track

I-Track is the national, second-generation surveillance system focused on IDU. This system builds on previous research studies conducted in Canada and was developed in response to the need for a consistent approach in the collection of risk behaviour information across Canada. People who have injected drugs in the past 6 months and who meet the age limit of consent for the given province/territory (age varies by site according to provincial/territorial ethical considerations) are eligible to participate in I-Track.

The pilot phase of I-Track was undertaken between October 2002 and August 2003 at selected urban and semi-urban sites across Canada (Regina, Sudbury, Toronto, Victoria and the SurvUDI network [Province of Quebec and the city of Ottawa]).⁹ The pilot phase demonstrated the feasibility of the sentinel surveillance system and also laid the foundation for undertaking Phase 1 of the I-Track. Phase 1 was completed in seven sites (Regina, Sudbury, Toronto, Victoria, the SurvUDI network, Winnipeg and Edmonton) between October 2003 and May 2005.¹⁰ Phase 2 was completed in 10 sites between 2005 and 2008 (Regina, Sudbury, Toronto, Victoria, Vancouver Northern and Central Interior Islands, Prince George, the SurvUDI network, Kingston, Thunder Bay and Edmonton). Implementation of Phase 3 started in April 2010.

Selected findings from I-Track are presented in the *Epi Update* chapter entitled "HIV/AIDS Among People Who Inject Drugs in Canada."

M-Track

M-Track is the national, second-generation HIV surveillance system that monitors HIV and related risk behaviours among gay, bisexual, and other men who have sex with men in Canada. This surveillance system also builds upon earlier local research efforts. MSM who

meet the age limit of consent for the given province/territory (age varies by site according to provincial/territorial ethical considerations) are eligible to participate in M-Track.

M-Track was first implemented in Montreal in 2005. Between 2006 and 2007, four additional sites joined M-Track: Toronto, Ottawa, Winnipeg and Victoria. Over 4,500 men participated in M-Track between 2005 and 2007 (Phase 1). In 2008, Vancouver became the most recent site to implement the system, and as of 2009 a total of six sites have participated in M-Track across Canada.

Selected findings from Phase 1 of M-Track are presented in the *Epi Update* chapter entitled "HIV/AIDS Among Gay, Bisexual and Other Men Who Have Sex with Men in Canada."

Strengths and limitations

Results from the Track surveillance systems are collated from sentinel sites and provide an important national perspective on risk behaviours in key at-risk populations. Track data are collected by cross-sectional surveys and, while it is not possible to examine causality directly, these surveillance data offer a valuable source of information critical to service and prevention programs at all levels: national, provincial and local. In addition, because of the relatively large survey samples, adequate statistical power is available to examine risk behaviours and their associated factors.

Track surveys primarily use venue-based sampling methods to overcome some of the inherent difficulties in accessing hard-to-reach populations. Given this, the surveillance findings may not be representative of the entire target population in Canada (e.g. the I- and M-Track findings are not representative of *all* IDU and MSM in Canada). Underreporting of some risk behaviours may occur because of social desirability biases.

Acknowledgements

National-level HIV and AIDS surveillance is possible as a result of all provinces and territories participating in and setting directions for HIV and AIDS surveillance. PHAC acknowledges the provincial/territorial HIV/AIDS coordinators, public health units, laboratories, health care providers and reporting physicians for sharing non-nominal, confidential data for national surveillance.

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Mission

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

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HIV/AIDS Among Youth in Canada

At a Glance

- Since reporting began, youth between the ages of 15 and 29 years have accounted for 26.5% of all positive HIV test reports.
- Behavioural data on young Canadians demonstrate risk of HIV transmission in terms of risky sexual behaviours and knowledge gaps.
- Data from targeted studies show that street-involved youth, youth who inject drugs and young men who have sex with men are particularly vulnerable to HIV infection.
- A wide range of prevention activities need to be implemented to help minimize the risk of HIV transmission among youth.

Introduction

In general, youth (defined here as between 15 and 29 years of age) are vulnerable to HIV infection as a result of many factors, including risky sexual behaviour, substance use (including injection drug use) and lack of information or misinformation regarding HIV transmission. To adequately profile HIV and AIDS in the youth population, it is necessary to supplement current Canadian HIV/AIDS surveillance data with other relevant data sources, such as health surveys, incidence/prevalence studies and data on sexually transmitted infections (STIs). This chapter provides an overview of the most recent HIV/AIDS surveillance data (both routine and enhanced) on Canadian youth as well as a summary of recent research on factors associated with HIV risk behaviour and HIV transmission.

Routine Surveillance

The Public Health Agency of Canada's Centre for Communicable Diseases and Infection Control (CCDIC) collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, death data are also collected.

Health care providers and/or laboratories forward this information to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS diagnoses to the Centre, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, underreporting, missing information and undiagnosed infections. (Please refer to Chapter 3 for a full description of HIV/AIDS surveillance in Canada.)

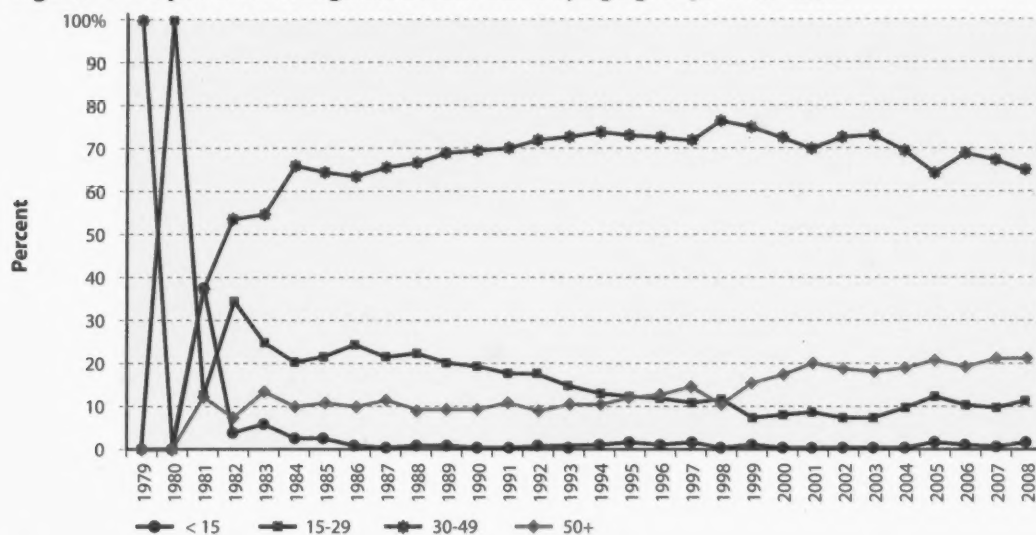
AIDS surveillance data

The total number of AIDS cases reported to the Public Health Agency of Canada (PHAC) from 1979 to December 31, 2008, was 21,300.¹

Trends among youth aged 15 to 29

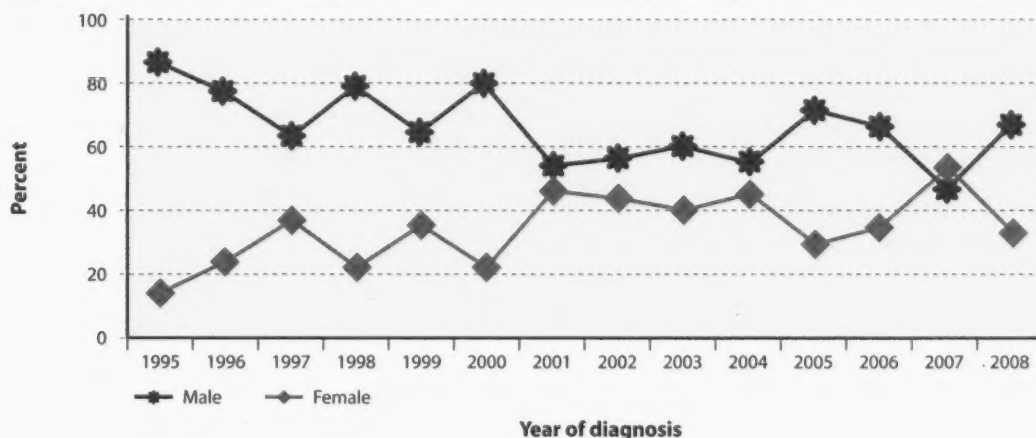
- The proportion of AIDS cases attributed to the 15-29 year age group decreased steadily from 34.6% in 1982 to a low of 7.5% in 1999 and since then increased slightly to 11.8% of all cases in 2008 (Figure 1).



Figure 1. Proportion of diagnosed AIDS cases by age group, 1979-2008**Sex**

- From 1983 to 1995, males accounted for over 85% of annual AIDS cases among youth aged 15-29. This gap has been shrinking steadily, and in 2007 the proportion of AIDS cases among female youth exceeded the proportion among male youth for the first

time since reporting began in 1979 (Figure 2). In 2008, among youth, males accounted for 66.7% of AIDS cases and females accounted for 33.3% of AIDS cases reported to PHAC.

Figure 2. Proportion of diagnosed AIDS cases among youth aged 15-19, by sex, 1995-2008**Exposure category**

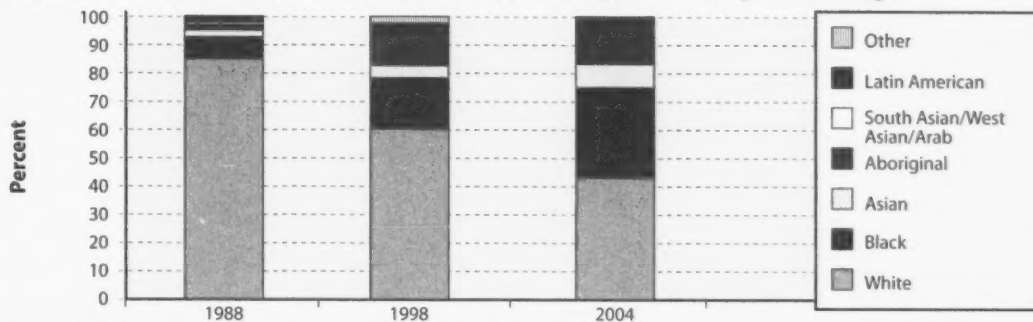
- Since 2000, among youth the proportion of AIDS cases attributed to the exposure category men who have sex with men (MSM) has increased from 26.3% to 42.9%.
- Similarly, since 2000, the proportion of AIDS cases attributed to people who inject drugs (IDU) has increased from 31.6% to 42.9%.
- Meanwhile, since 2000, among youth the proportion of AIDS cases attributed to heterosexual contact has decreased from 34.2% to 14.3%.

Ethnicity/race

As shown in Figure 3, the proportion of AIDS cases among Black and Aboriginal youth increased between 1988 and 2004 by 24.5 percentage points and 15.9 percentage points, respectively. The proportion of AIDS cases among

people who identified themselves as White has decreased steadily, and cases among other ethnicities/races have remained relatively constant.

Figure 3. Proportion of AIDS cases among youth aged 15-29, by ethnic origin



Note: Because of changes in the reporting of AIDS cases in Ontario, ethnicity/race was not available for cases reported after the second half of 2005.

Table 1. Cumulative AIDS cases among youth (ages 15-29) from 1979 to December 31, 2008

	15-19 years old, % <i>n</i> = 74	20-29 years old, % <i>n</i> = 3,287
Sex		
% female	25.7	14.9
Exposure category	<i>n</i> = 65	<i>n</i> = 3,087
MSM	15.4	62.0
MSM/IDU	6.2	7.5
IDU	12.3	9.5
Heterosexual contact	10.8	17.3
Blood/blood products	53.8	3.6
Perinatal	0.0	0.0
Other*	1.5	0.0
Ethnic status	<i>n</i> = 51	<i>n</i> = 2,475
Aboriginal	2.0	5.3
South Asian/West Asian/Arab	2.0	0.6
Asian	0.0	1.8
Black	7.8	11.9
Latin American	0.0	1.9
White	88.2	77.9
Other	0.0	0.6

*Other includes occupational exposure, perinatal and other.

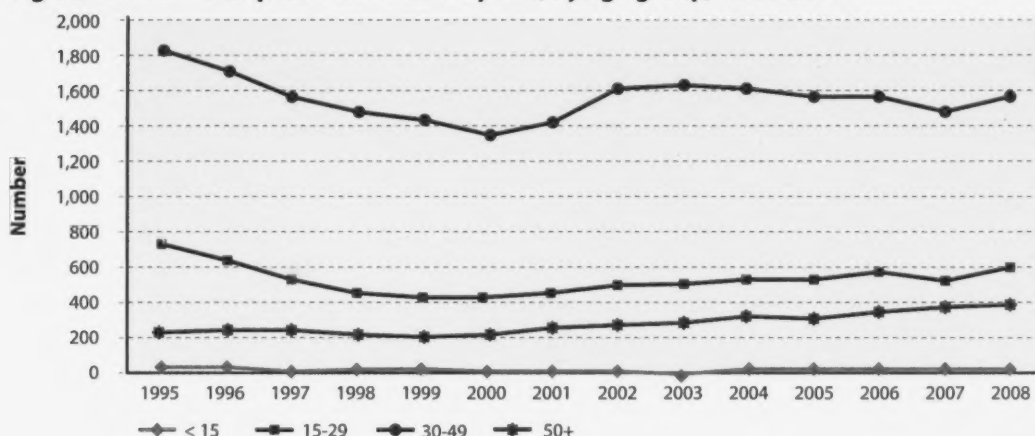
HIV surveillance data

Since HIV reporting began in 1985 to December 31, 2008, there have been a cumulative number of 67,442 positive HIV test reports in Canada.

Trends among youth aged 15 to 29

■ In 1985, the proportion of positive HIV test reports attributed to the 15-29 year age group was 39.5%, after which the proportion among youth decreased steadily to a low of 20.8% in 1999. Between 1998 and 2008, youth accounted for approximately 21%-23% of annual HIV test reports (Figure 4).

Figure 4. Number of positive HIV test reports, by age group, 1995-2008

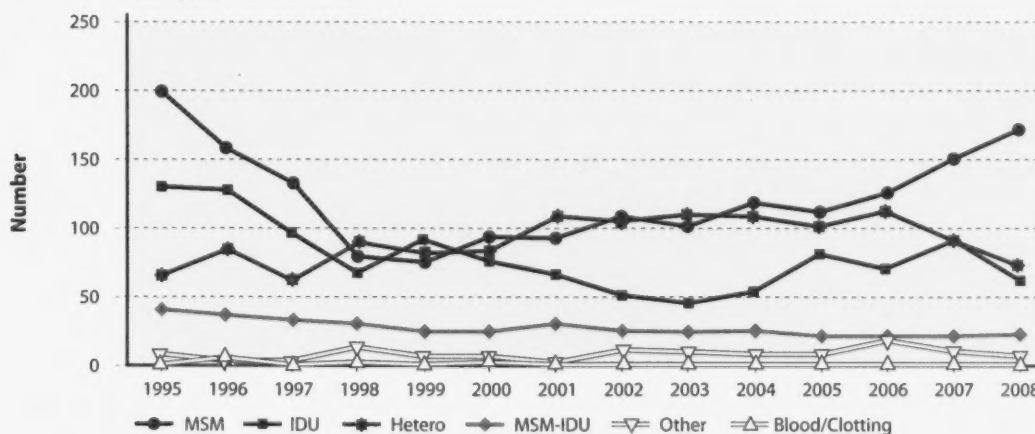


Exposure category

■ In the early years of the epidemic (1985-1990), over 70% of annual positive HIV test reports among youth were attributed to the MSM exposure category, with smaller proportions attributed to the IDU and heterosexual contact exposure categories. By 1999, the proportion of positive HIV test reports attributed to these three exposure categories was nearly equal (IDU 35.1%, MSM 28.7%, heterosexual 30.9%).

■ In 2008, the highest proportion of positive HIV tests reports among youth was attributed to the MSM exposure category, at 53.9% ($n = 172$), followed by heterosexual contact at 22.9% ($n = 73$) and IDU at 19.4% ($n = 62$) (Figure 5).

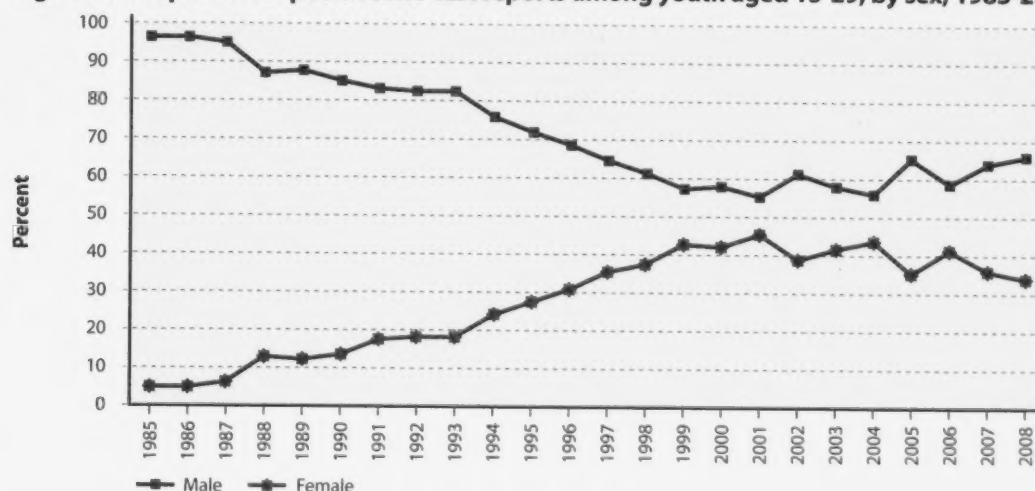
Figure 5. Number of positive HIV test reports among youth aged 15-29, by exposure category, 1995-2008



Sex

- When reporting began in 1985, the male:female ratio of positive HIV test reports among youth was nearly 20:1, 95.8% of positive HIV test reports occurring among males (Figure 6). By 2001, the proportions of positive HIV test reports among males and females in this age group were nearly equal (54.8% and 45.2% respectively). Since then, the proportion among males has ranged from 57% to 67%.
- In 2008, the proportion of positive HIV test reports among all females was highest in the 15-29 year age group and represented 33.5% of all positive HIV test reports among youth. The proportion among females decreased for all successive age groups: 30.9% in the 30-39 year age group, 21.5% in the 40-49 year age group and 15.1% in the 50 years and over age group.
- In 2008 the only age group in which there was a higher number of positive HIV test reports among females than males was in the 15-19 year age group; the male-to-female ratio was 0.7:1.

Figure 6. Proportion of positive HIV test reports among youth aged 15-29, by sex, 1985-2008



Race/ethnicity

There are several limitations associated with reported race/ethnicity status, and thus caution is recommended in interpreting these data. Information on race/ethnicity is not available for all provinces and territories, most notably Ontario and Quebec. As a result of the variation in reporting, the race/ethnicity status reflected in positive HIV test reports should not be viewed as representative of Canada. Other caveats are the limited choices for identification of race/ethnicity on case report forms, possible misclassification and underreporting.

- Since race/ethnicity reporting for HIV began in 1998 the majority of annual positive HIV reports have been among people who identified themselves as White, except in 2005 and 2008 when this group was surpassed by people identified as Aboriginal.
- The proportion of positive HIV test reports among youth identified as White has shown a generally decreasing trend, from 51.0% in 1998 to 33.5% in 2008.
- The proportion of positive HIV test reports among youth identified as Aboriginal has shown a generally increasing trend, from 28.8% of positive HIV test reports in 1998 to 40.9% in 2008.
- In 2008, the majority of positive HIV test reports were among people who identified themselves as Aboriginal (40.9%), followed by White (33.5%), then Latin American and Black (both at 7.9%).

Table 2. HIV-positive test reports among youth (ages 15-29) from 1985 through December 31, 2008

	15-19 years old, % <i>n</i> = 957	20-29 years old, % <i>n</i> = 15,624
Sex		
% female	44.7	22.7
Exposure category	<i>n</i> = 603	<i>n</i> = 9,020
MSM	35.0	59.5
MSM/IDU	2.7	3.2
IDU	24.9	16.3
Heterosexual contact	25.5	16.9
Blood/blood products	10.1	2.0
Other*	1.8	2.0
Ethnic status (from 1998-2008)	<i>n</i> = 209	<i>n</i> = 1,698
Aboriginal	48.3	31.0
South Asian/West Asian/Arab	0.5	2.7
Asian	1.4	4.3
Black	6.7	12.7
Latin American	1.9	3.8
White	40.2	44.9
Other	1.0	0.5

*Other includes occupational exposure, perinatal and other.

Enhanced Surveillance/Population-Specific Surveillance Data

Overall description of "Tracks"

As part of the *Federal Initiative to Address HIV/AIDS in Canada*, PHAC monitors trends in HIV prevalence and associated risk behaviors in key populations identified in Canada through second-generation HIV surveillance systems. The overall objectives of these systems (known as the "Track" systems) are to describe the changing patterns in the prevalence and incidence of HIV infections, risk behaviour practices and testing patterns for HIV, hepatitis C and other sexually transmitted and blood borne infections (STBBIs) in each respective population. For a more detailed description of the Track systems, please refer to Chapter 3.

I-Track

I-Track is the national, second-generation HIV surveillance system of people who inject drugs (IDU). This system builds on previous research studies conducted in Canada and was developed in response to the need for a consistent approach in the collection of risk behaviour information across Canada. People who have injected drugs in the previous 6 months and who meet the age limit of consent for the given province/territory (age varies by site according to provincial/territorial ethical considerations) are eligible to participate in I-Track.

Summary of descriptive data from I-Track Phase 2 (2005-2008):²

- The proportion of youth (participants less than 29 years old) who reported borrowing used needles in the previous 6 months was 26%, compared with 21% among participants aged 30-49 and 17% among participants aged 50 and older.
- Youth I-Track participants reported the lowest rate of consistent condom use during anal (42%) and vaginal (55%) sex.
- Over 90% (*n* = 2,972) of I-Track participants reported ever having been tested for HIV; of youth participants (*n* = 690), 88.7% had ever been tested for HIV. Among youth who reported that their most recent HIV test was negative, 69% reported having been tested for HIV in the previous 2 years.
- Among participants who provided a biological sample of sufficient quantity for testing and who completed a questionnaire, the prevalence of HIV among youth was 6%, compared with 16% and 15% among participants aged 30-49 and 50 and older respectively. Of youth participants whose biological sample tested positive for HIV, 33% were unaware of their HIV positive status, compared with 19% of unaware respondents over 30 years of age.

M-Track

M-Track is the national, second-generation HIV surveillance system built on earlier local efforts and focused on gay, bisexual and other MSM in Canada. Men who have ever had sex with another man and who meet the age limit of consent for the given province/territory (age varies by site according to provincial/territorial ethical considerations) are eligible to participate in M-Track.

Summary of descriptive data from M-Track Phase 1 (2005-2007):³

- Across five sentinel sites 4,838 men participated in Phase 1 of M-Track, of whom 26% were 29 years of age or less.
- The majority of all men who participated in M-Track reported multiple male sex partners (i.e. more than one male partner), including oral and/or anal sex, in the 6 months preceding survey administration (64%). Similarly, among youth MSM who participated in M-Track, 66% reported multiple male partners.
- Among youth MSM who reported having anal sex with a casual male partner* in the previous 6 months, nearly half (48%) reported consistent ("Always") condom use during anal sex (insertive and/or receptive) compared with 45% among M-Track participants over the age of 30.
- Most men (86%) who participated in M-Track reported ever having been tested for HIV; among youth MSM this proportion was 75%. Further, among youth MSM who reported that their most recent HIV test was negative, 80% had been tested for HIV in the 2 years preceding survey participation.
- Among youth participants who provided a biological sample of sufficient quantity for testing and who completed a questionnaire, the prevalence of HIV was 4%. The overall prevalence of HIV in M-Track Phase 1 was 15%.
- Of all M-Track participants whose biological sample tested positive for HIV, 19% were unaware of their HIV-positive status.[†] Of youth participants, the proportion unaware of their HIV-positive status was 34%.

* A casual partner is a man with whom the respondent had sex only once (a "one night stand" or an encounter in a bathhouse, for example). Casual partners do not include men who received from or gave to the respondent any money, drugs or other goods or services in exchange for sex.

† Excludes respondents who did not provide answers to questions regarding HIV testing history.

Summary of Recent Research

In addition to the data gathered through routine and enhanced HIV surveillance, several studies have explored and documented HIV and associated risk factors among youth in Canada. Recent research among youth has provided insight and documented trends in the areas of HIV/AIDS knowledge and sexual health, patterns in condom use and sexual partners, as well as testing behaviors and other STIs.

Knowledge of HIV/AIDS and sexual health

Research shows that knowledge gaps exist among youth regarding what constitutes risky sexual behaviour.

For example:

- Between December 2006 and August 2007, the Toronto Teen Survey⁴ interviewed 1,216 Toronto teens aged 13 to 18 and found that only 62% of youth received sexual health education in school. While almost 92% of youth surveyed had received some form of sexual health education, 8% had had none at all. The survey found that 18% of youth new to Canada reported never having received any sex education. In terms of where youth obtain their sexual health information, 31% of females and 23% of males reported accessing sex information on line. When asked about HIV/AIDS, 78% reported learning about HIV/AIDS in school, but HIV/AIDS remained one of the top three areas they would have liked to learn more about. Youth reported that their questions related to sex were most frequently answered by friends (53%), professionals (43%), mass media (33%), parents (28%), siblings, info lines and semi-professionals.
- The 2006 HIV/AIDS Attitudinal Tracking Survey of 303 Canadian youth aged 16-24⁵ found that in response to the question: "How is HIV passed on to another person?", 69% correctly identified intercourse between men, 78% correctly identified unsafe intercourse between a man and a woman, and 30% were aware that sharing needles was a factor associated with the transmission of HIV.
- Based on survey data from 64 countries*, the 2008 UNAIDS *Report on the Global AIDS Epidemic* reported that 40% of males and 38% of females aged 15-24 had accurate and comprehensive knowledge about HIV and about how to avoid transmission.⁶ This percentage is based on the number of young

* The 64 countries are not specified. These figures come from the UNAIDS 2008 *Report on the Global AIDS epidemic*; please refer to this report for further information.

men and women aged 15-24 who both correctly identified ways of preventing the sexual transmission of HIV and who rejected major misconceptions about HIV transmission. This is an improvement over 2005 knowledge levels but is still well below the global goal of ensuring that 95% of young people have comprehensive HIV knowledge by 2010.

- A 2006 survey of 112 Canadian university students aged 17 to 28 who were participating in the Canadian International Model United Nations Conference (CAN-IMUN) in Ottawa found that one-third of the respondents (32.7%) were not concerned about HIV/AIDS when engaging in sexual activity.⁷ Also of note was that almost one-third (31.4%) incorrectly identified the pill as protecting against HIV exposure. Moreover, other strategies incorrectly identified as being able to prevent HIV infection/transmission included pre-ejaculation withdrawal (16.2%), use of spermicides or contraceptive jellies (9.5%) and use of a diaphragm (6.7%).

Inconsistent condom use and sexual partners

Recent research in Canada has also documented low levels of, or inconsistent, condom use among youth, as well as high levels of casual sex and/or multiple sex partners. Certain subgroups of youth (e.g. street-involved or homeless youth) experience greater risk of exposure to HIV.

For example:

- *Sexual Health in Toronto 2007*⁸ found that individuals who became sexually active at a younger age were more likely to have multiple partners relative to those who had their first experience at an older age. Although 78% of youth reported condoms as their usual method of birth control, many do not use condoms for every act of intercourse, leaving them vulnerable to pregnancy and STIs.
- In the 2006 HIV/AIDS Attitudinal Tracking Survey,⁵ Canadian youth (aged 16 to 24) rated their personal risk of contracting HIV. Most participants (77%) perceived themselves to be at low risk of contracting HIV and 20% at moderate risk. Perceived risk of contracting HIV was higher among youth compared with respondents in other age groups. This is not altogether surprising given that youth in this survey reported the highest number of casual and multiple sex partners. While youth in this study reported the second-lowest rates of being sexually active in the previous 12 months (second only to those aged 65+), they reported the highest rates of having more than one partner. When asked if they had used a condom the last time they had sex, 50% reported that they had not.
- Among participants in the 2005-2006 At Risk Youth Study ($n = 529$), sexual activity in the previous 6 months was reported by 78.4%; 47.8% reported multiple sex partners and 24.0% reported consistent condom use in the previous 6 months.⁹ Housing status was a strong and independent correlate of both greater numbers of sex partners and inconsistent condom use; living in a shelter or hostel was positively associated with an elevated number of recent sex partners.
- A 2009 study of condom use among Canadian youth ($n = 2,145$) found that youth perceived significant peer pressure that might influence their use of condoms.¹⁰ Young women may not push for condom use if they feel that doing so might convey sexual knowledge and/or significant sexual experience. Young men (aged 15 to 23) were less likely than young women to discuss sex openly for fear of appearing "foolish, stupid or unmanly". It has been shown that communication with sexual partners about condom use was among the strongest predictors of condom use.¹¹

Testing behaviors/access to care

Research in Canada reveals that youth are not consistently seeking information or services from health care professionals.

For example:

- The Toronto Teen Survey found that 83% of youth surveyed reported that they had never visited a health care provider for any sexual-health-related reason.⁴
- In a 2006 survey of 112 Canadian university students aged 17 to 28, 46% of the respondents indicated they had never seen a health care professional for treatment or information about sexual health.⁷
- A 2007 Vancouver and Prince George study involving 543 Aboriginal youth (aged 14-30) who used drugs found that 74% of participants reported having had an HIV test during their lifetime, of whom 46% were tested regularly (i.e. at least once per year).¹² Overall, 8% of participants were HIV positive.
- In a 2004 community-based mixed methods study, a sample of 413 Aboriginal youth (mean age 21.5) from nine Canadian cities completed a survey.¹³ The data were collected through 11 community-based organizations, including urban Aboriginal AIDS service organizations and health and friendship centres. The testing rates may not be representative of Aboriginal youth, since some of the recruitment was done in settings that provided HIV testing services. Of the youth surveyed, 50.8% of participants had been tested for HIV ($n = 210$) and, of these, 12.4% were HIV positive. The most common reasons for testing were having sex without a condom (43.6%) and being or thinking

that they were pregnant (35.4%). The most commonly reported reasons for not getting tested were self-perception of being at low risk of HIV (45.3%) and of not having had sex with an infected person (34.5%). Youth who had been tested for HIV were more likely than those who had not to report a previous STI, a history of injecting drug use or having had anal sex with any partner. The largest percentage of youth (34.1%) had gone to a physician for their most recent HIV test, another 17.1% had gone to a hospital, 14.6% had gone to a community or public health centre and 13.7% had attended a walk-in clinic.

Youth and sexually transmitted infections other than HIV

STIs continue to be a significant and increasing public health concern in Canada. Reported rates of chlamydia, gonorrhea and syphilis have been rising since 1997. As HIV and other sexually transmitted infections have common routes of transmission (e.g. blood, semen and other bodily fluids), risk behaviours (e.g. unsafe sexual and drug use practices) and risk factors (e.g. poverty, homelessness and overcrowding), increases in rates of STIs such as chlamydia, gonorrhea and syphilis are indicators of potential HIV transmission or infection.

In PHAC's 2007 Report on Sexually Transmitted Infections in Canada, the reported rate of chlamydia among females was almost twice as high as that of their male counterparts, and 82.8% of reports were among those under the age of 30.¹⁴ The overall reported rate of gonorrhoea increased by 124.2% between 1998 and 2007. The majority of reported cases occurred in those under 30 years of age. Females between the ages of 15 and 24 and males between the ages of 20 and 24 accounted for the highest reported rates of gonorrhoea. The overall reported rate of infectious syphilis increased by 516.7% between 1998 and 2007. Reported rates of infection were highest among males aged 30 to 39; among females, highest rates were reported among those 25 to 29 years old. During this period, outbreaks were reported in Vancouver, Edmonton, Calgary, Winnipeg, Toronto, Ottawa, Montreal and the Yukon among MSM and in heterosexual populations. In 2007, those under 30 years of age accounted for 22.1% of syphilis cases.

Comments

HIV/AIDS is affecting certain higher-risk subgroups of the Canadian population, including at-risk youth. Sexual risk behaviour and STI data indicate that the potential for HIV transmission remains significant among young Canadians.

The research findings show that a large proportion of youth are not aware of all HIV modes of transmission. Such knowledge gaps need to be addressed by public health education and prevention programs.

More incidence and prevalence information, as well as trend data on HIV-related risk behaviours, are needed in order to guide and evaluate prevention programs for young Canadians. Further epidemiologic and behavioural data for high-risk youth, such as street youth, are also needed to fully assess the risk of HIV transmission in Canada's youth population.

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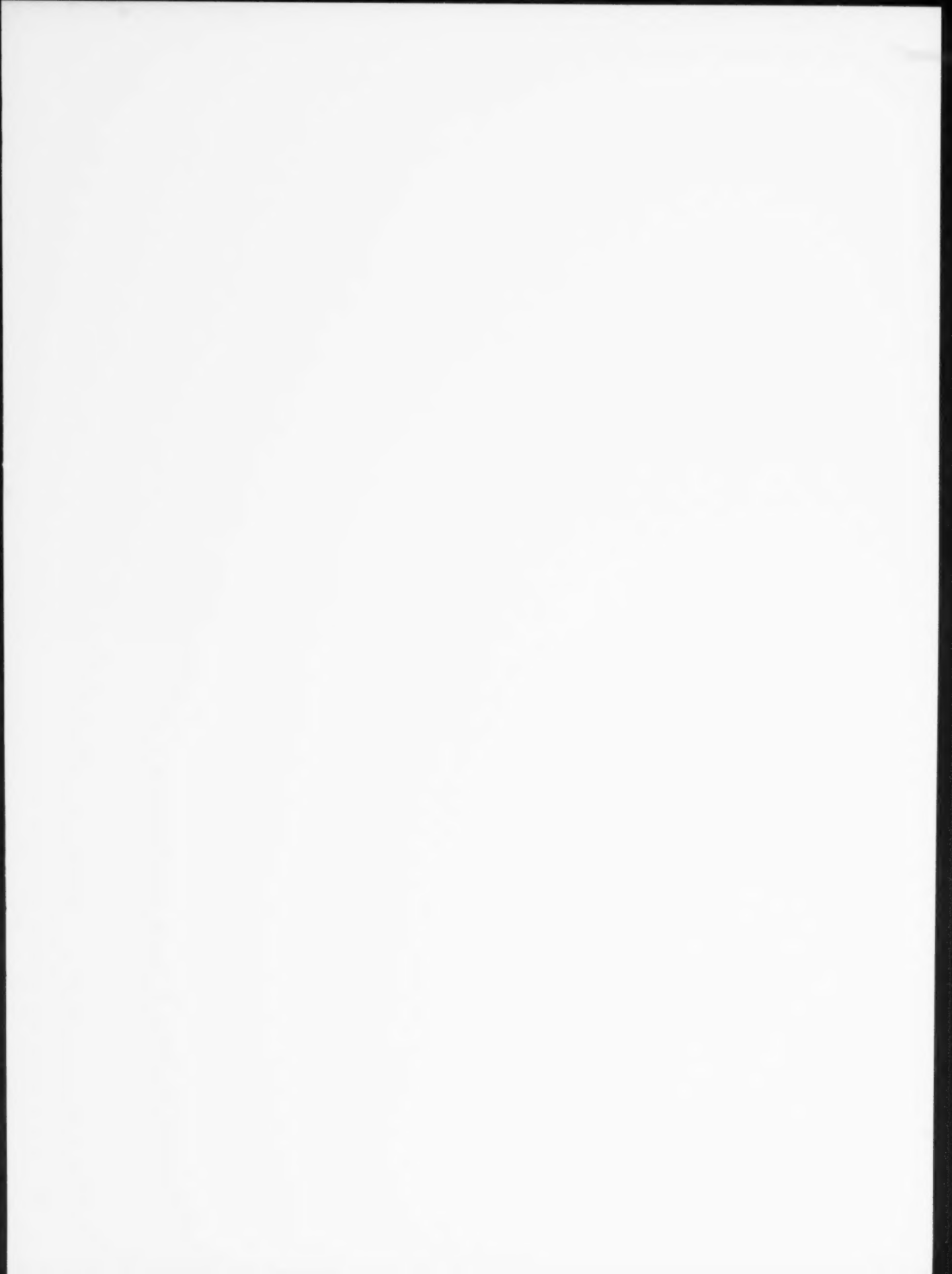
Mission

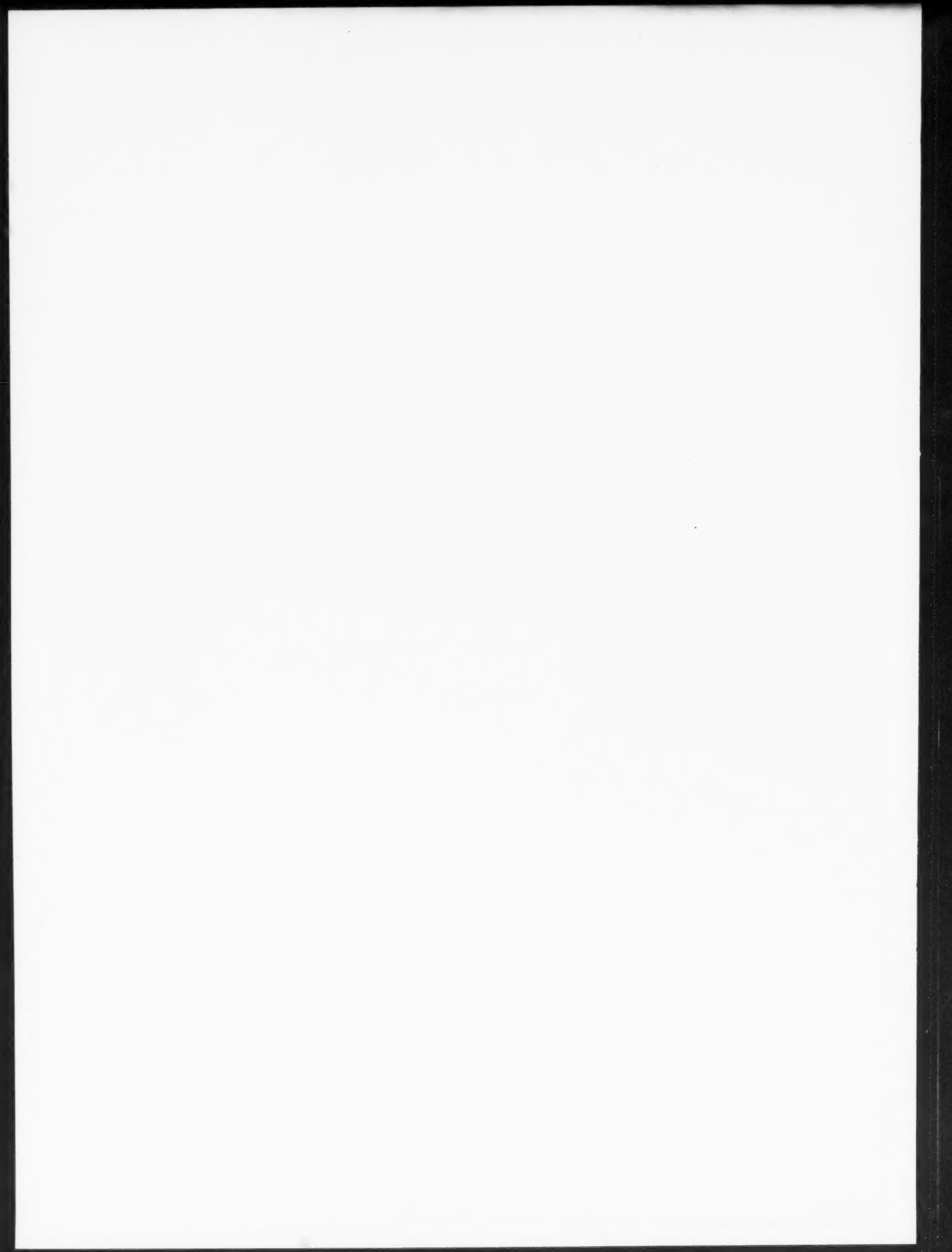
To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

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HIV/AIDS Among Women in Canada

At a Glance

- In Canada, a total of 2,001 AIDS cases and 10,799 positive HIV tests were reported among adult females up to December 31, 2008.
- Women represent an increasing proportion of those with positive HIV test reports in Canada, and in 2008 they accounted for 26.2% of such reports.
- Heterosexual contact and injection drug use are the two main risk factors for HIV infection in women.

Introduction

While HIV and AIDS affect both women and men, there are important differences between the sexes in the physical mechanisms, as well as in socio-economic factors and consequences associated with HIV infection. These stem from biology, sexual behaviour and socially constructed gender differences between men and women, roles and responsibilities, access to resources and decision-making power.¹

Worldwide, females aged 15-24 are 1.6 times more likely to be infected with HIV than their male peers.² In Canada, women now account for both a significantly larger number and proportion of people living with HIV and AIDS relative to the beginning of the epidemic. This *Epi Update* chapter will examine the current status and trends of women living with HIV/AIDS in Canada through routine and enhanced surveillance data. It will provide estimates of the HIV prevalence and incidence among women and will also highlight relevant research pertaining to HIV/AIDS. For the purposes of this chapter, "women" is defined as adult females aged 15 and over, unless explicitly defined otherwise.

The following are definitions and distinctions relating to sex and gender:

- Sex refers to the biological characteristics, such as anatomy (e.g. body size and shape) and physiology (e.g. hormonal activity or functioning of organs), that distinguish males and females. Sex differences may occur at the genetic/molecular, cellular, organ or organism level and result from complex interactions between genetic, hormonal and environmental factors that commence in the genetic and intrauterine environment and continue throughout the lifespan of the individual. Sex differences begin with the observation that every animal-derived cell has a sex.
- Gender refers to the array of socially constructed roles and relationships, personality traits, attitudes, behaviours, values, relative power and influence that society ascribes to two sexes on a differential basis.

In this *Epi Update* chapter, the data refer to biological sex as recorded by the health care practitioners who complete the case report forms. Where the results of research studies are discussed, the terminology used in the original research documentation is maintained in this *Epi Update*.



Routine Surveillance

The Public Health Agency of Canada's Centre for Communicable Diseases and Infection Control (CCDIC) collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, death data are also collected.

Health care providers and/or laboratories forward this information to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS diagnoses to the Centre, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, under-reporting, missing information and undiagnosed individuals. (Please refer to Chapter 3, entitled "HIV Testing and Surveillance Systems", for a full description of HIV/AIDS surveillance in Canada).

AIDS surveillance data

In Canada there have been 21,300 cumulative AIDS cases reported to the Public Health Agency of Canada (PHAC) as of December 31, 2008. Of these, 21,046 were adults (15 years and older) with known sex, and 2,001 cases or 9.5% of all adult cases were female. Between 1979 and 1998, 8.1% of AIDS diagnoses were made among females (all ages); this has increased over time, and in 2008 females accounted for 24.7% of total diagnoses. The number of women whose condition was diagnosed as AIDS in 2008 represents an 18.9% increase from the previous year.

Age groups

The 30-39 year age group has accounted for the largest proportion of AIDS cases among women throughout the epidemic, with nearly double the number of reports compared with the next most reported age group (20-29 years) (Table 1). This pattern is similar to that of AIDS case reports among men in Canada, of which the 30-39 year age group also made up the largest proportion of cases; however, in contrast to women, the second most reported age category was the 40-49 age group.

Table 1. AIDS case reports among women by age group, cumulative cases as of December 31, 2008

Age group (years)	Total female AIDS cases	% of total female AIDS cases
15-19	19	0.9%
20-29	489	24.4%
30-39	810	40.5%
40-49	424	21.2%
50-59	150	7.5%
60+	109	5.4%

Over the past 10 years, the 30-39 year age group accounted for 39.9% of AIDS diagnoses among women, which is comparable to the group's average from 1985-1998. A significant change in the proportion was evidenced over the last 10 years, however, in the 20-29 year age group, which dropped to an average of 17.9%, 6.5% below the group's historical average over the whole epidemic. The 40-49 year age group, by contrast, rose to 28.3% of AIDS diagnoses among women, an increase of 7.1% above its historical average.

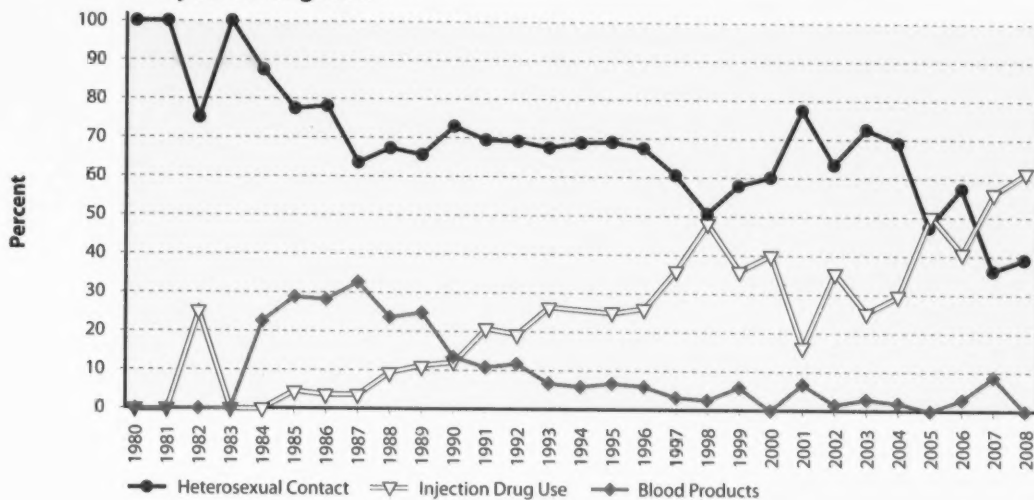
Exposure category

Among AIDS case reports for women with known exposure category, the primary reported risk factor since the beginning of the epidemic has been heterosexual contact, which as recently as 2001 accounted for over 75% of all AIDS cases among women. Over the duration

of the epidemic, heterosexual contact has accounted for a cumulative 1,168 reported cases or 65.5% of all AIDS cases among women. Injection drug use exposure is attributed to 26.0%, and the receipt of blood or blood products, occupational exposure, or other exposures have represented 8.5% of all AIDS cases among women to date. Over the past 10 years, there has been a steady rise in the percentage of cases attributed to injection drug use exposure among women. In 2001, this risk exposure was attributed to 16.4% of reported AIDS cases among women.

In 2005, it surpassed heterosexual contact as the most reported exposure category, dipping back below in 2006 before peaking in 2008, when this exposure category reached an all-time high of 60.9% of all cases (Figure 1).

Figure 1. Percent distribution of AIDS cases in women by exposure category and year of diagnosis



Ethnicity/race

Black and Aboriginal women are disproportionately affected by AIDS relative to women of other ethnic or racial background. Between 1979 and 2008, of cases (all ages) reported as Black or Aboriginal, 35.2% and 29.0% respectively were female. This is in comparison with the 9.9% overall proportion of females among all AIDS cases. Among White, Asian/Arab and Latin American AIDS cases, 6.2%, 8.1% and 8.4% of cases respectively were female.

HIV surveillance data

Trends

The trend in sex distribution since the beginning of the HIV/AIDS epidemic has been one of a steady increase in the proportion of positive HIV test reports for women.

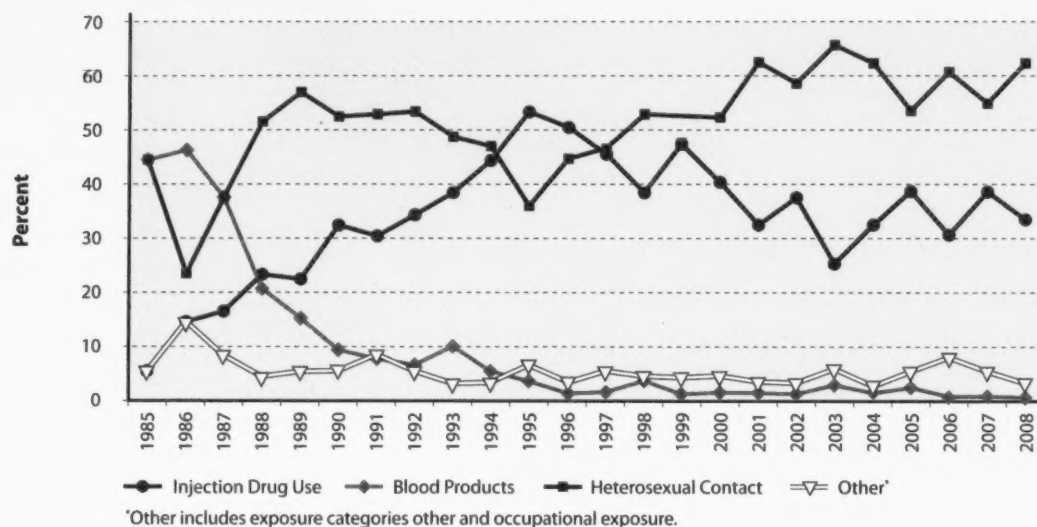
Prior to 1999, females represented 11.7% of all positive HIV test reports. By 2006, this figure had risen to 27.8%, the highest percentage since the start of the epidemic. Surveillance data for 2008 demonstrated a slight decline in the number and proportion of positive HIV tests reported among women compared with 2006. Among adults (15 years of age and older) in 2008 with reported sex information, 669 (26.2%) of all positive tests were among females.

Exposure category

Since the beginning of the epidemic, heterosexual contact and injection drug use have been the two largest exposure categories among women. Reported heterosexual contact accounted for the largest proportion of adult female HIV case reports for all years, except during a 4-year period (1994-1997) when it was surpassed by injection drug use exposure (Figure 2).

During the period 1999 to 2008, the proportion of cases attributed to heterosexual contact exceeded the proportion attributed to injection drug use. For heterosexual contact the proportion ranged from 47.2% in 1999 to a high of 65.8% in 2003, with an average of 58.2%. The cumulative average for this exposure category for the period 1999 to 2008 was 53.6%. The proportion for the injection drug use exposure category fluctuated over the same 10-year period, reaching a high of 47.2% in 1999 and a low of 25.2% in 2003, with an average of 35.5% over the decade (Figure 2).

Figure 2. Percent distribution of HIV case reports in women by exposure category and year of diagnosis



Between 1999 and 2008, among positive HIV tests reported for females between 15 and 19 years of age, injection drug use exposure accounted for 49.3% of the cases compared with 17.6% among men in the same age group, highlighting the significance of injection drug use in the transmission of HIV among young women. In 2008, women accounted for 41.9% of all HIV test reports attributed to injection drug use exposure.

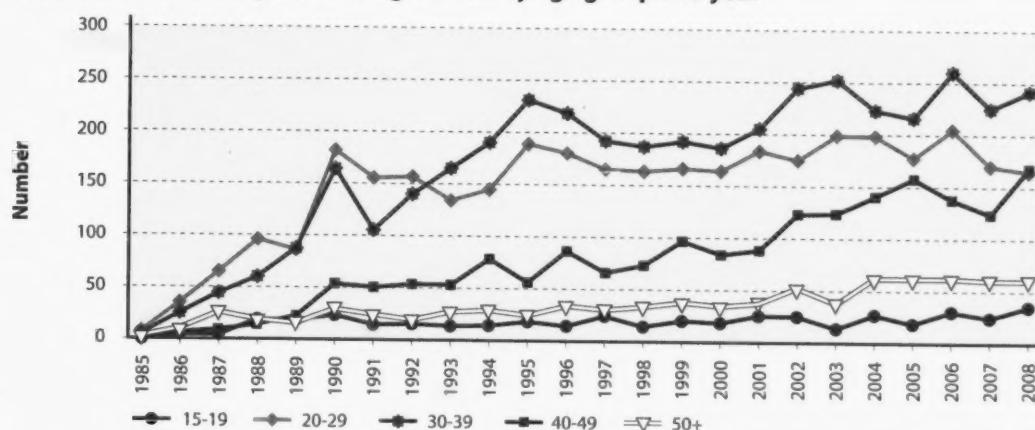
Case reports in the heterosexual contact exposure category can be broken down to reveal trends among different subcategories. Surveillance data for 2008 demonstrated that females made up 53.1% of positive HIV reports attributed to the heterosexual/endemic subcategory, which indicates the heightened vulnerability of females born in HIV-endemic countries* relative to their male peers. The heterosexual/non-endemic subcategory includes people who test positive for HIV and report heterosexual contact with someone who is either HIV positive or at increased risk of HIV infection; in 2008, 48.7% of cases in this sub-

category were women. Within the heterosexual/no identified risk subcategory, which comprises people infected with HIV for whom heterosexual contact is the only risk factor reported and nothing is known about the HIV risk of the partners, women accounted for 43.2% of test reports in 2008.

Age group

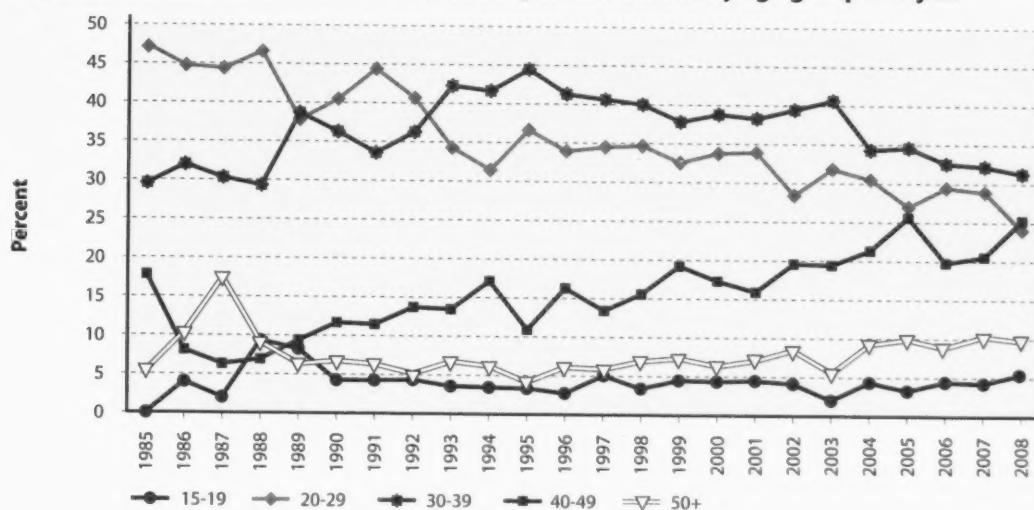
There has been a steady rise in the number of HIV case reports among women of almost all age categories in Canada since the beginning of the epidemic. The number of positive HIV tests reported for women in the 20-29 age group rose over a 10-year period from 1985 to 1995 and then levelled off. There was a similarly notable rise in the number of reports for women in the 30-39 age group during this period; after 1995 the rate of increase continued but was less pronounced. Since 1995, the steepest increase has occurred among women in the 40-49 group, which rose from 56 reported cases in 1995 to a high of 168 in 2008 (Figure 3).

* Refer to Chapter 12 for more information on HIV/AIDS among persons who originate from countries where HIV is endemic.

Figure 3. HIV case reports among women by age group and year

Shifting from absolute numbers to proportions of each age group among female HIV case reports, the trend varies somewhat. In 1985, the highest proportion of positive HIV test reports were for women in the 20-29 age group, but the trend has been downwards ever since. In 1993, the highest proportion of positive HIV test reports were for women in the 30-39 age group, and this group

has since accounted for the greatest proportion of all HIV positive test reports among females. This age group peaked in 1995 at 44.7% and since then decreased to 36.0% in 2008. Women aged 40-49 years continue to account for an increasing percentage of positive HIV test reports among women, reaching the same level as the 20-29 group for the first time in 2008, at just over 25.0% (Figure 4).

Figure 4. Percent distribution of HIV case reports in women by age group and year

Females account for a substantial proportion of positive HIV test reports among the youngest adults (15-19 yrs.). In 2008, young females between 15 and 19 years of age represented the majority (59.3%) of all test reports in this age group, a trend noted since 1997. This trend is in contrast to all other age groups, in which males were the majority: of all positive test reports in those aged 20 to 39 years old females represented 30.8%, and of those aged 40 years and over they represented 19.3%.

Race/ethnicity

There are several limitations associated with reported race/ethnicity, and thus caution is recommended in interpreting these data. Information on race/ethnicity is not available for all provinces and territories, most notably Ontario and Quebec. As a result of the variation in report-

ing, race/ethnicity data reflected in positive HIV test reports should not be viewed as representative of Canada. Other issues to consider include a limited choice for identification of race/ethnicity on case report forms, misclassification and underreporting.

Of positive HIV test reports from 1998 to 2008 (all ages) with reported sex information, the majority of adult male cases (15 years and over) were identified as White (66.4%) and a minority as Aboriginal people (16.9%) and Black Canadians (6.6%) (Figure 6). Among women, on the other hand, the race/ethnicity distribution was different, the highest proportion of positive HIV tests being reported for cases identified as Aboriginal (42.9%), followed by White (33.3%); Black Canadians represented (18.8%) of total reported cases (Figure 5).

Figure 5. Percentage of positive HIV reports among women by race/ethnicity, 1998-2008

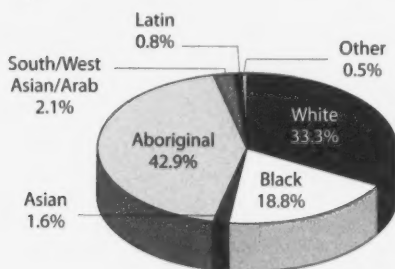


Figure 6. Percentage of positive HIV reports among men by ethnicity, 1998-2008

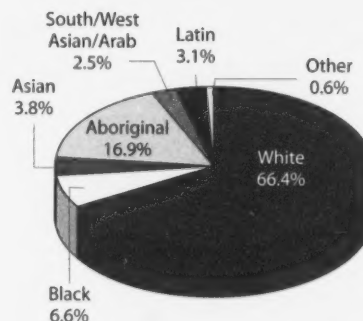
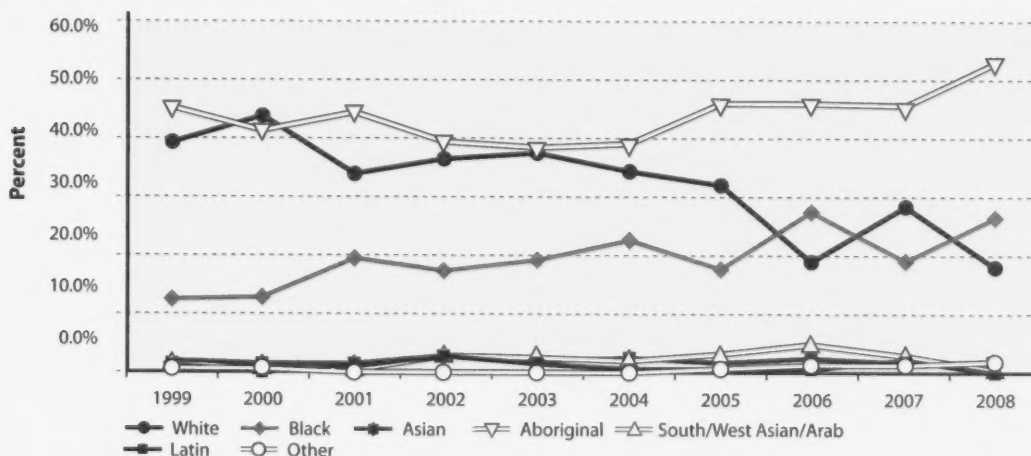


Figure 7. Percent distribution of positive HIV reports race/ethnicity and year



When race/ethnicity reporting began in 1998, the largest proportions of HIV case reports for both women and men were among cases identified as White or Aboriginal (Table 2). In 1998, 52.3% of all positive HIV test reports for women were cases identified as White; 33.5% were identified as Aboriginal. Over the next decade however, the annual proportion of HIV positive test reports for White

women declined, reaching a low of 18.7% in 2008. Over the same period, Aboriginal women represented an increasingly higher proportion of positive HIV test reports, reaching a high of 52% of all case reports among women in 2008. The other notable trend over this period was seen in Black women, among whom the proportion also increased, from 12.2% in 1999 to 26.3% in 2008 (Figure 7).

Table 2. Comparison of HIV case reports among women by race/ethnicity, 1998 vs 2008

1998	White	Black	Asian	Aboriginal	South/west Asian/Arab	Latin	Other	Total
Females	81	12	2	52	6	1	1	155
Males	348	22	11	68	16	13	0	478
2008	White	Black	Asian	Aboriginal	South/west Asian/Arab	Latin	Other	Total
Females	37	52	3	103	1	0	2	198
Males	265	43	31	93	8	28	6	474

Enhanced Surveillance/Population-Specific Surveillance Data

Description

As part of the *Federal Initiative to Address HIV/AIDS in Canada*,³ PHAC monitors trends in HIV prevalence and associated risk behaviours in key vulnerable populations identified in Canada through second-generation HIV surveillance systems. The overall objectives of these systems (known as the "Track" systems) are to describe the changing patterns in the prevalence and incidence of HIV infections, risk behaviour practices and testing patterns for HIV, hepatitis C and other sexually transmitted and blood borne infections (STBBIs) in each respective population.

I-Track is the national second generation HIV surveillance system focused on people who inject drugs (IDU). This system builds on previous research studies conducted in Canada and was developed in response to the need for a consistent approach in the collection of risk behaviour information. For a more detailed description of the Track systems, please refer to Chapter 3.

Summary of data/findings

During Phase 2 of I-Track data collection (2005-2008, 10 sentinel sites across Canada) the total sample was 3,287. The majority of participants were male (68%). The overall prevalence of HIV among I-Track Phase 2 participants was approximately 14% with no significant difference between males (14%) and females (12%). In the total sample, 91% of males and 93% of females had ever been tested for HIV.

Sex-based analyses of the I-Track Phase 2 data⁴ showed important sex-based differences in risk behaviours among survey participants, particularly in the pattern of lending and borrowing needle/syringes/equipment. For example, compared with males, a significantly higher proportion of females reported borrowing used needles/syringes to inject drugs (26% females versus 20% males), lending used needles/syringes (29% versus 20%) and lending used injection equipment (45% versus 35%). When asked whom they borrowed from most often, females reported borrowing used needles/syringes from their regular sex partners (59% versus 34%), whereas a higher proportion of males reported borrowing from their close friends (40% males versus 29% females), people they did not know well (19% versus 6%) and people they did not know at all (5% versus 2%). With regard to education, a higher proportion of males reported completing high school (24% males versus 18% female) and had some post-secondary education (25% versus 23%).

National estimates of HIV/AIDS prevalence and incidence

PHAC uses multiple methods to provide an overall picture of the HIV epidemic among all Canadians living with HIV (including AIDS), both diagnosed and undiagnosed. Using these combined methods, PHAC produces two types of estimate: prevalence, the number of people living with HIV (including AIDS), and incidence, the number of new infections in a 1-year period. PHAC produces estimates of national HIV prevalence and incidence approximately every 3 years. Please refer to Chapter 1, "National HIV Prevalence and Incidence Estimates in Canada for 2008".

At the end of 2008, there were an estimated 14,300 (12,200-16,400) women living with HIV (including AIDS) in Canada, accounting for about 22% of the national total. This represents a 17% increase from the 12,200 (10,400-14,000) estimated for 2005. There were 600 to 1,120 new HIV infections among women in 2008, representing 26% of all new infections. For 2005, it was estimated that 590 to 1,100 new HIV infections occurred in women, accounting for about 26% of all new infections among women. With respect to exposure category, a slightly lower proportion of new infections were attributed to the heterosexual category in 2008 compared with 2005 (71% versus 73%), whereas a slightly higher proportion were attributed to IDU (29% in 2008 and 27% in 2005).

Summary of Recent Research

The following section examines recent research regarding HIV/AIDS and females/women. With a Canadian focus, it mentions some of the key issues surrounding the vulnerability of females/women to HIV transmission, including commercial sex work, sexual violence and pregnancy.

HIV/AIDS and female sex workers

Research published in a 2008 article by Shannon et al.⁵ explored the correlates of drug sharing among female sex workers and their clients. There is a well-established association between exchanging sex and smoking crack cocaine, both in this setting and elsewhere.⁶⁻⁸ This suggests a significant potential for sharing of drugs through a sex-for-drugs or money transaction.

In this study of female sex workers in Vancouver ($n = 198$), over half (59%) of the survival sex workers reported drug sharing with clients, crack cocaine being the most common drug shared. The study found these behaviours to be associated with other factors previously linked to an increased likelihood of infectious disease transmission, including multiple unprotected sexual encounters and intensive crack cocaine smoking.

Another study by Spittal et al.⁹ examined risk behaviours among street involved females who inject drugs. This study was conducted in Vancouver and Montreal, cities that have undergone HIV epidemics among IDU. The results indicated that female injectors, including females in the sex trade, are at heightened risk of HIV transmission because they are more likely to have multiple sex partners and have intimate partners who use injection drugs. The study, which was conducted from 1999 to 2000, found that women injectors who reported sex trade involvement had higher risk profiles but not a higher HIV prevalence rate relative to women injectors not involved in the sex trade. These findings are contrary to a number of studies in the United States, which indicate that participation in the sex trade is independently associated with HIV infection. In the Spittal et al study, the sex trade workers were found to be younger and had shorter injection careers than non-sex-trade workers, and patterns of sexual risk were similar for both groups. It was found, however, that sex trade workers engaged in higher risk injection practice and drug use patterns, including greater than once-per-day heroin use, frequent use of smokeable crack cocaine and borrowing of used syringes.

The Cedar Project conducted from 2003 to 2005¹⁰ organized the only cohort study of young Aboriginal people involved in illegal drug use in North America. The objective of the study was to examine the socio-demographic characteristics, drug use patterns, injection practices, sexual experiences, and HIV and hepatitis C virus (HCV) prevalence among young Aboriginal women aged 14-30 who used illegal drugs and were involved in recent sex trade, for comparison with those women not involved in sex work. The study discovered an independent association between recent sex work involvement and lifetime experience of sexual abuse, recent daily cocaine injection use and recent daily non-injection crack use.

Of the 262 females who participated in the study, 154 (58.8%) reported involvement in sex work in the previous 6 months, and 185 (70.6%) reported being involved in sex work at some point in their lives. Lifetime sexual abuse was significantly associated with sex work in univariable and multivariable analysis. Sexual abuse was reported to have first occurred during early childhood, at a median age of 6 years old. Out of 260 participants, 34 (13.1%) were found to have HIV antibodies, and 109 (41.9%) had HCV antibodies. The study also found that women involved in sex work were more likely to be HCV positive than those who were not (49.0% vs. 36.0%).

When examining the structural and environmental barriers to condom use negotiations, Shannon et al.¹¹ found an association between being pressured into unprotected sexual intercourse and sex work district location, highlighting the role of working conditions in shaping women's sexual risk of HIV transmission. Women who moved their sex trade working areas away from main streets (possibly because of previous solicitation or drug charges) experienced a 3-fold increase in the odds of being pressured into unprotected sexual intercourse, and those servicing clients in cars or public spaces experienced a 2-fold increase in being pressured into unprotected sex.

The practices of clients offering more money to not use a condom and of female sex workers charging more money for unprotected intercourse have been documented, with evidence suggesting that both drug use and poverty drive these practices.¹²

Women and sexual violence

It has been shown in various settings that the epidemics of HIV and violence are closely linked.^{13,14}

Worldwide, women aged 15-24 are 1.6 times more likely to be infected with HIV than their male peers.¹⁵ Between 20% and 50% of all women indicate that their first sexual experience was forced or unwanted.¹⁶ Fear of violence prevents women from seeking voluntary counselling and testing for HIV, returning for their test results, getting treatment if they are HIV positive or accessing services to prevent mother-to-child HIV transmission.¹⁷

A study done by Stockman et al.¹⁸ was based on a population drawn from the National Survey of Family Growth conducted by the Centers for Disease Control and Prevention in the United States. It proposed that mechanisms linking sexual violence to the engagement of HIV risk behaviours, including heightened sexual behaviour, easy arousal and/or psychopathology (e.g. depression, post-traumatic stress disorder), lead to decreased ability to negotiate safe sexual behaviours.

In bivariate and multivariate analyses, women reporting a coerced first sexual intercourse showed the highest risk of having multiple sex partners and engaging in substance abuse, followed by women reporting coerced sex after sexual debut. Among the women in the subsample reporting sexual coercion, only consuming alcohol or drugs at coerced sex was independently and significantly associated with multiple sex partners and substance abuse.

HIV prevention for women forced into sex by their partners may require different strategies according to their history, especially a coerced first time experience, as well as type of sexual coercion experienced.

Pregnancy and HIV

Pregnancy and HIV is another pressing issue faced by women at risk of or affected by HIV. Mother-to-child transmission can occur during gestation (*in utero* transmission) or during delivery as the newborn comes into contact with maternal blood and cervical-vaginal secretions. In the absence of any intervention, it is estimated that 25.0% of pregnant women who are HIV positive will transmit the virus to their infant either during pregnancy or at birth.¹⁸ Antiretroviral therapy is effective in reducing mother-to-child transmission of HIV, and yet several infants perinatally exposed to HIV are confirmed infected each year in Canada, which implies the need for further development of therapies and improved access to and uptake of treatment.

For further information regarding pregnancy and HIV, please refer to chapter 7 on perinatal transmission of HIV.

Conclusion

Women in Canada, especially those who use injection drugs and have high-risk sexual partners, are increasingly becoming infected with HIV, and women now account for over a quarter of new positive tests annually. The evolving epidemic in this group demonstrates the need for further data on the trends, risk factors and geographic differences in HIV/AIDS among women in Canada in order to develop gender-specific prevention and care initiatives and programs. It is essential that these programs target both sexual and injection drug risk behaviour as well as the intersection between the two, in addition to the underlying factors that put women at increased risk of HIV infection.

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HIV/AIDS Among Older Canadians

At a Glance

- As of December 31, 2008, 12.4% (2,644) of all reported AIDS cases occurred in people 50 years of age or older.
- The proportion of annual positive HIV test reports among those aged 50 years and older increased from 10.6% in 1999 to 15.3% in 2008.
- Sexual contact is the predominant risk factor reported for HIV test reports among older Canadians. In 2008, the exposure categories of men who have sex with men and heterosexual contact made up similar proportions of HIV test reports, accounting for 38.5% and 38.0% respectively.
- Males account for the majority of reported AIDS and positive HIV test reports among older Canadians, representing 92.6% and 84.9% of all reports in 2008 respectively.

Introduction

HIV/AIDS has generally been viewed as a disease affecting younger people; however, it has become apparent that older Canadians are not only affected by but are also at risk of HIV infection. For the purpose of this document, "older" is defined as 50 years of age and older.

Older persons living with HIV may have been infected with the virus after the age of 50, or they may have been infected at a younger age and survived into older age. More and more HIV-positive individuals are surviving for longer, largely as a result of medical advances such as highly active antiretroviral therapy. In turn, the HIV/AIDS prevalence rate is affected by those surviving into older age.

Several factors may put older Canadians at increased risk of HIV infection, such as limited knowledge of modes and risks of HIV transmission, increasing divorce rates,¹ access to sexual performance enhancing drugs,^{2,3} misconceptions about sexuality in older age in the health care and policy fields, and age-related physiological changes, such as tissue fragility.⁴

The intent of this chapter is to summarize trends in HIV and AIDS surveillance data in older Canadians and to highlight findings from a growing body of Canadian and international research, which have implications for the prevention and diagnosis of HIV/AIDS among older Canadians.

Routine Surveillance

The Centre for Communicable Diseases and Infection Control (CCDIC) of the Public Health Agency of Canada (PHAC) collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, death data are also collected.

Health care providers and/or laboratories forward this information to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS diagnoses to the Centre, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, under-reporting, missing information and the inability to capture information on undiagnosed infections.

(Please refer to Chapter 3, "HIV Testing and Surveillance Systems", for a full description of HIV/AIDS surveillance in Canada.)

AIDS surveillance data

Summary of data/findings

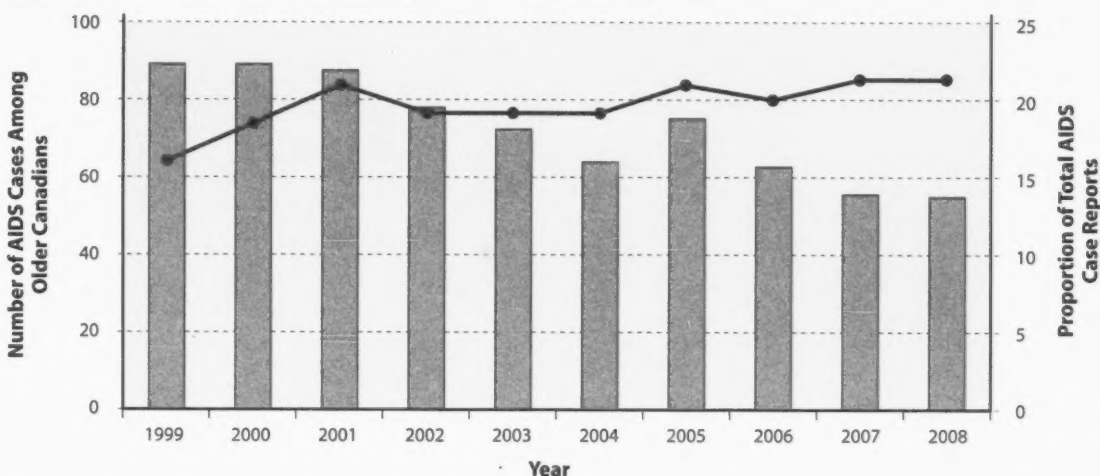
The total number of AIDS cases with known age information reported to CCDIC from 1979 to December 31, 2008, was 21,298. Of these reports, 2,644 (12.4%) were among older Canadians (age 50 and over);⁵ the majority (90.2%) of the 2,644 were males, who reported having sex with men (61.3%) and identified themselves as White (85.3%).

Over the past 10 years, there has been an increase in the percentage of AIDS case reports among older Canadians, as well changes in the male:female ratio and reported exposure categories in this age group.

Description of trends

As shown in Figure 1, a general upward trend has been observed in the annual percentage of AIDS case reports among older Canadians. Over the past 10 years, the percentage of total AIDS reports among older Canadians ranged from 15.9% in 1999 to 21.6% in 2008, a 35.8% increase.

Figure 1. AIDS Case Reports Among Older Canadians, by Year

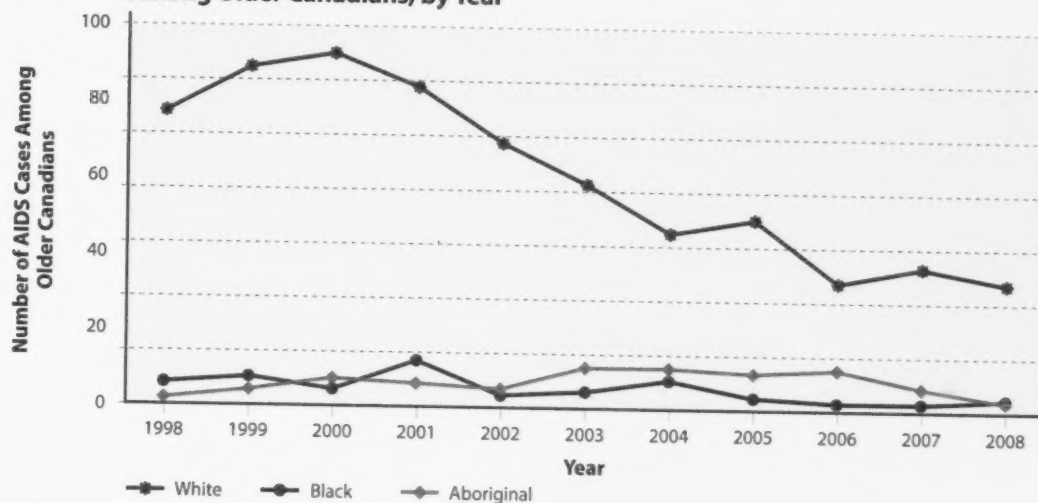


From 1999 to 2008, among older Canadians the number of reported AIDS cases indicating an exposure category of men who have sex with men (MSM) has generally decreased. This same time period also saw a general increase in the percentage of reported cases among older Canadians attributed to IDU (people who inject drugs), ranging from 5.3% to 26.1%. Heterosexual contact accounted for roughly one-quarter to one-third of reported AIDS cases among older Canadians between 1998 and 2008, with the exceptions of 2006 and 2007, when heterosexual exposure accounted for 54.3% and 61.3%.

Reported AIDS cases among older Canadians tend to be male: 88.0% of all cases since 1999 and 92.6% in 2008.

With respect to the ethnicity/race of reported AIDS cases since 1999, the majority were identified as White, followed generally by Aboriginals and then Blacks, as shown in Figure 2. Because of changes in the reporting of AIDS cases in Ontario, data on ethnicity/race were not available for cases reported after the second half of 2005.

Figure 2. Most Frequently Reported Race/Ethnicities of AIDS Cases Reports Among Older Canadians, by Year



HIV surveillance data

Summary of data/findings

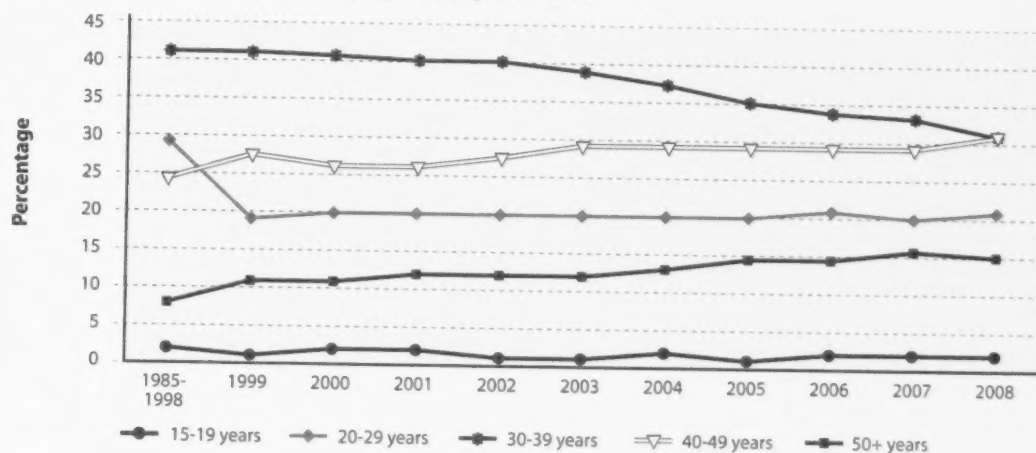
Since HIV reporting began in 1985 up to December 31, 2008, a total of 67,442 positive HIV test have been reported to PHAC, of which 62,762 included age information⁵. Of these reports, 6,036 (9.6%) were older Canadians (age 50 years and over). The majority (86.4%) of the reports were among men, the most frequently reported risk exposure category was MSM (48.7%), and the majority self-identified as White (74.3%).

Description of trends

There has been a decreasing proportion of positive HIV test reports among younger adults (ages 15-39) and an increasing proportion among older adults, as shown in Figure 3.

In the past 10 years, a general upward trend can be observed in the proportion of positive HIV test reports among older Canadians, ranging from 10.6% in 1999 to 15.3% in 2008. Further, the number of annual positive HIV test reports has increased among those 50 years old and over by 76.5% since 1999. This is the largest increase over the 10-year period, aside from those aged 15-19, whose numbers increased by 93.5%.

Figure 3. HIV Case Reports by Age Group and Year

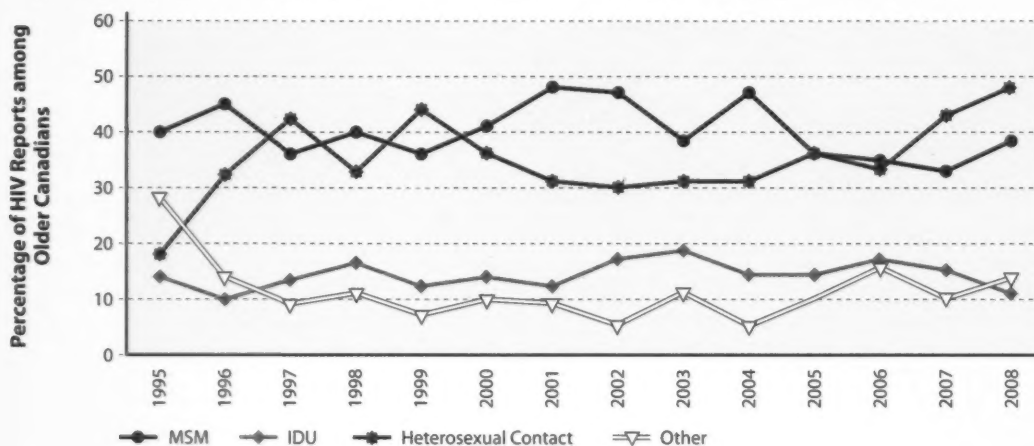


Over the past 10 years, the highest percentage of positive HIV test reports among older Canadians has generally been attributed to the MSM exposure category, as shown in Figure 4. However, in the past 20 years there has been a decrease in the percentage of HIV cases in the MSM exposure category and an increase in those in the heterosexual exposure category. From the period 1985-1998 to 1999-2008 the proportion of positive HIV test reports in the MSM exposure category decreased from 58.6%

of all reports (3.8 times the proportion of heterosexual reports) to 39.9% of all reports (1.1 times greater than heterosexual reports).

The proportion of positive HIV test reports among older Canadians in the injection drug use exposure category has varied over the past 10 years. However, it has generally declined since 2003, showing a high of 19.1% to a low of 10.6% in 2008.

Figure 4. Exposure Category of HIV Case Reports Among Older Canadians, by Year



There are several limitations associated with reported race/ethnicity, and thus caution is recommended in interpreting these data. Information on ethnicity/race is not available for all provinces and territories, most notably Ontario and Quebec. As a result of the variation in reporting, the ethnic status reflected in positive HIV test reports should not be viewed as representative of Canada. Other issues related to reported ethnicity/race are a limited choice for identification of ethnic or racial status, misclassification and underreporting.

With respect to race/ethnicity for reported HIV cases among older Canadians, individuals identified as White have accounted for the majority of positive HIV test reports each year and for 74.3% of the reports with known ethnicity/race since 1998; reports for individuals identified as Aboriginal and Black accounted for 12.9% and 5.6% respectively.

A gradual decline can be observed in the proportion of positive HIV test reports among older men and a corresponding increase among women since the beginning of the epidemic. During the 1985-1996 period, women made up 10.5% of HIV reports among older Canadians as compared with 15.8% during 1997-2008. In 2008, males represented 84.9% of positive HIV test reports among older Canadians.

Summary of Recent Research

Recent research has identified some trends among older people in the areas of HIV/AIDS prevention, diagnosis and treatment/outcomes. These trends have implications for the education of older persons about HIV/AIDS transmission, HIV/AIDS testing guidelines and outreach policies, and future directions in medical research.

Prevention

Recent research suggests that older adults in Canada and elsewhere tend to be less informed about HIV/AIDS and its transmission than other adult age groups. For example, the 2006 Canadian HIV/AIDS Attitudinal Tracking Survey⁶ reported that seniors (65 and older) tended to be unaware that an HIV-positive person is more susceptible to a number of illnesses and diseases than those who are seronegative; were more likely than young Canadians to believe that HIV/AIDS can be cured; were more likely to incorrectly believe that HIV can be transmitted through a sneeze or a cough; were aware of the fact that they know less than other Canadians on the issue of HIV/AIDS; and were most likely to agree that HIV/AIDS is mostly a gay person's disease or a Third World disease.

There is also evidence that physicians do not regularly discuss sexual issues with patients aged 50 and older. A large study of people in the United States ($n = 3,005$) over the age of 57 reported that "a total of 38% of men and 22% of women reported having discussed sex with a physician since the age of 50 years".⁷ This trend appears to continue despite an apparent increase in sexual activity among older people.^{3,8}

Older people's lack of HIV/AIDS awareness does not necessarily correspond to lack of HIV risk. While Canadians aged 65 years and older in the HIV/AIDS Attitudinal Tracking Survey were in the age group least likely to report sexual activity in the previous 12 months (30%), this age group had the highest percentage of any age group that reported not having used a condom the last time they had sex and perceiving that they had no risk of infection.⁶

Recent studies of older adults with HIV/AIDS suggest that risk behaviour is prevalent in this subpopulation. One study, which involved 290 HIV-positive adults aged 50+ recruited from AIDS service organizations in four large cities in the United States, found that of those who were sexually active in the previous three months ($n = 110$), 33% had had unprotected anal or vaginal intercourse. This was reported by 27% of the male heterosexual respondents, 36% of the gay/bisexual male respondents and 35% of the heterosexual female respondents.⁹

Another recent US study interviewed 624 men aged 49 and older who were either HIV positive or HIV negative and who engaged in high-risk sexual activities. This study found that in the previous six months, 25% of both the HIV-negative and HIV-positive respondents had had more than one sexual partner. Further, only 18% of the HIV-negative men and 58% of the HIV-positive men always used condoms with their sexual partners.¹⁰

Diagnosis

Along with limited knowledge of HIV transmission, the uptake of HIV testing among older Canadians appears to be low. For example, a study of 219 on- and off-reserve rural Aboriginal people in British Columbia found that those over the age of 40 were least likely to undergo HIV testing.¹¹ Similarly, in a review of Australian surveillance data adults aged 50 and over were found to present later than younger adults for testing, regardless of sexual exposure category.¹² An American study of 488 women over the age of 50 in a population with a high HIV prevalence reported low rates of testing (35%) in this age group, testing rates decreasing significantly as age increased.¹³ Variables that predicted testing behaviour among these older women included being younger in age and recalling a health care provider recommending HIV testing.

Comment

The research described suggests that there are gaps both in Canada and internationally in the areas of HIV/AIDS education among older people, promotion of HIV testing among older adults and outreach to older high-risk populations. Such gaps affect counselling and treatment access for older people, as well as increasing older people's risk of HIV infection. Further research on HIV/AIDS and ageing will seek to shed light on these issues, which hold increasing importance for our ageing population.

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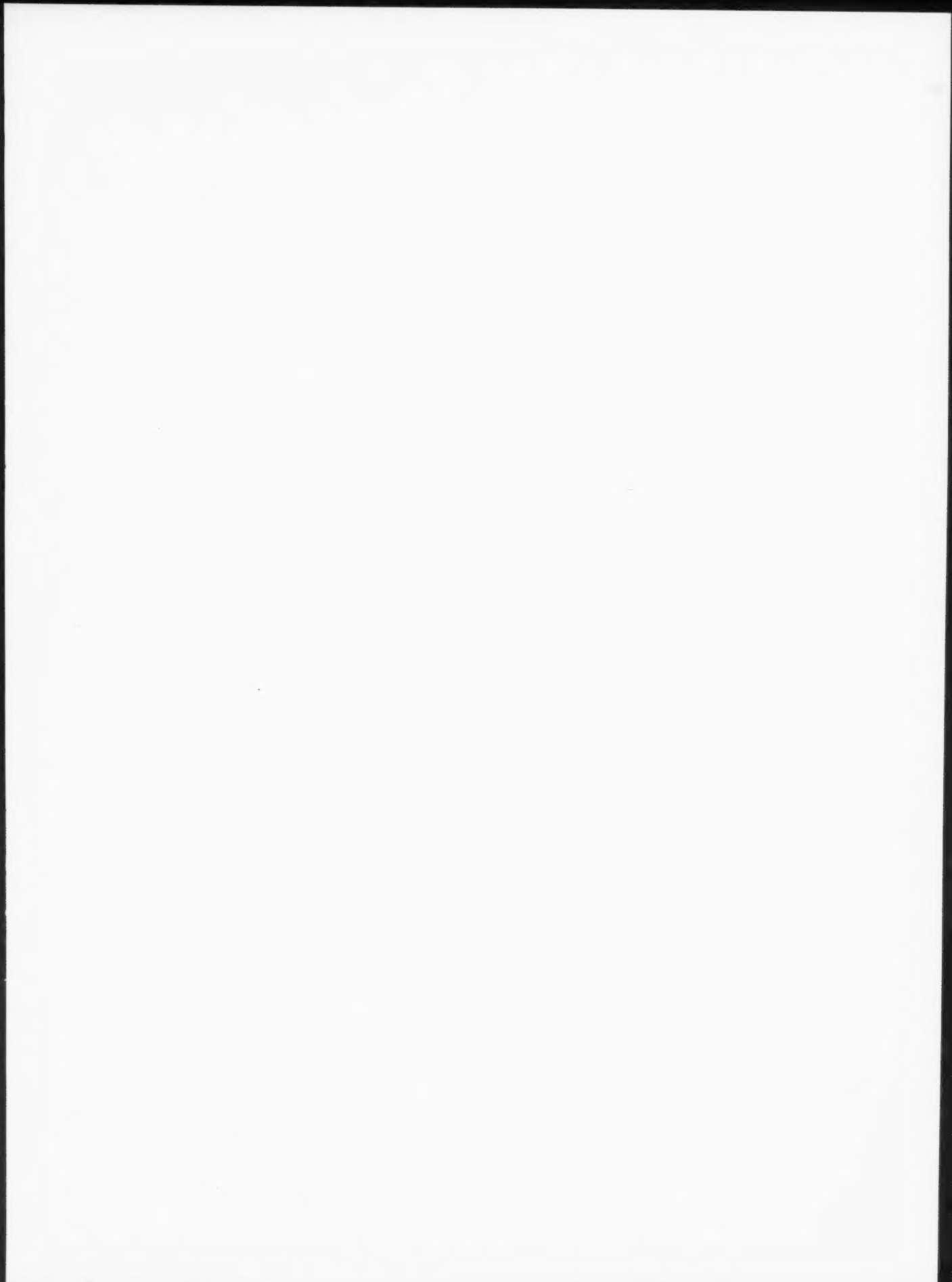
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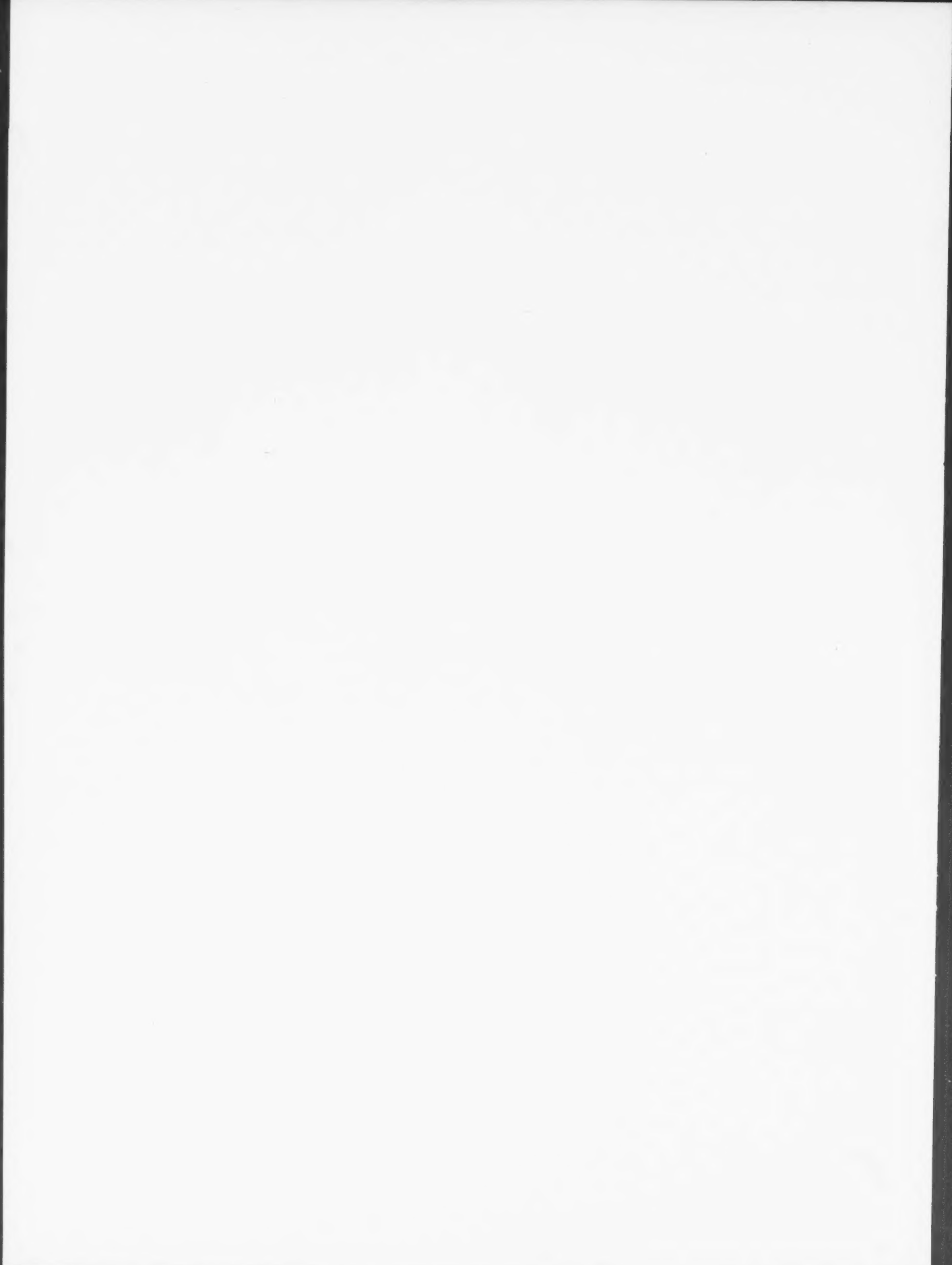
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Perinatal HIV Transmission in Canada

At a Glance

- The number of infants perinatally exposed to HIV is on the rise, although the mother-to-child transmission rate has declined significantly.
- Available data indicate high rates of HIV screening of pregnant women in Canada.
- Antiretroviral therapy is effective in reducing mother-to-child transmission of HIV, and research continues to identify new developments.
- Pregnant women of Aboriginal and black descent as well as female immigrants from HIV-endemic countries are overrepresented in the Canadian perinatal HIV data.

Introduction

Mother-to-child transmission of HIV can occur during gestation (*in utero* transmission) or during delivery when the newborn comes into contact with maternal blood and cervical-vaginal secretions. In the absence of any intervention, it is estimated that 25.0% of pregnant women who are HIV positive will transmit the virus to their infant either during pregnancy or at birth. If a seropositive mother breastfeeds her baby, the risk of transmission increases to an estimated 35.0%.¹

In 2008, it was estimated that 15.7 million women worldwide were living with HIV.² For this same year, approximately 1.4 million HIV-positive women gave birth to a child; 91.0% of these births occurred in sub-Saharan Africa.³

This *Epi Update* presents a profile of perinatal HIV transmission in Canada and discusses existing screening approaches for pregnant women in the provinces and territories.

Routine Surveillance of HIV

Data sources

The data presented in this section are derived from several provincial government sources. However, the majority of surveillance data were provided by the Canadian Pediatric AIDS Research Group (CPARG), a body that collects national data on the HIV status of newborns perinatally exposed to HIV. Support for the development of the Canadian Perinatal HIV Database has been provided by the Canadian HIV Trials Network and the Surveillance and Risk Assessment Division of the Public Health Agency of Canada (PHAC). Data on infants born to women known to be HIV positive during pregnancy are accessible in the annual publication *HIV and AIDS in Canada, Surveillance Report to December 31, 2008*.

The figures presented here relate to all newborns known to have been perinatally exposed to HIV in Canada. However, not all women know their HIV status, which means that not all HIV-positive pregnant women in Canada are included in the data; therefore, it would not be valid to calculate vertical transmission rates from the data.

National profile

Between 1985 and December 31, 2008, a total of 67,442 positive HIV tests were reported to PHAC. Of the 61,949 adult cases for which information on sex was available, 10,799 or 17.4%, were women. Of the positive HIV tests reported among adult women, 74.5% involved women who were 15 to 39 years of age.⁴



In the early 1990s, according to CPARG, between 50 and 80 newborns in Canada were known to have been perinatally exposed to HIV each year. In 2008 that figure had risen to 238 per year. Of the 2,851 newborns known to have been exposed to HIV between 1984 and 2008, 523 confirmed cases of infection and 2,291 cases confirmed not to be infected were reported. The infection status of the remaining 37 newborns has not been confirmed (and may include some infants who have been lost to follow-up). Of the 93 infants confirmed to be HIV infected since 2000, none died of AIDS-related causes, 11 died of causes other than AIDS, and 1 was lost to follow-up.⁴

Mother-to-Child Transmission Trends

International trends

Available data indicate that the rate of mother-to-child transmission in high-income countries has improved significantly since the introduction of antiretroviral therapies. In 2008 it was estimated that, since 2002, fewer than 250 infants had been born with HIV infection each year in the United States, representing a perinatal rate of less than 2.0%.⁵ In 1991, by contrast, the Centers for Disease Control and Prevention estimated that 1,650 infants had acquired HIV perinatally.⁶ In England in 2007, the rate of mother-to-child transmission was 2.0%, a significant decrease compared with the 12.0% national rate observed in 1999.⁷

National trends

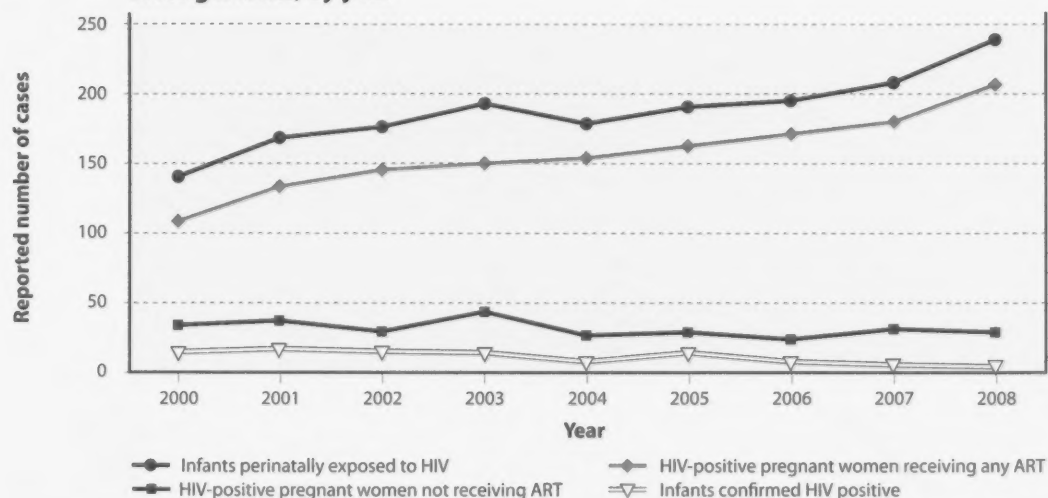
Overall, the situation of infants perinatally exposed to HIV has greatly improved during the past decade. As the number of persons living with HIV in Canada has increased, so too has the number of infants perinatally

exposed to HIV. However, the number of these infants who are subsequently confirmed to be infected has declined dramatically in recent years, both as a percentage and in absolute numbers. In 2001, for example, a total of 168 infants were perinatally exposed to HIV. Out of these, 17 (10.1%) were confirmed to be infected. In 2008, by contrast, 4 out of a total of 238 exposed infants (1.7%) were confirmed as infected. The more widespread administration of effective antiretroviral therapies (ART) has played a large role in this outcome: in 2008, 87.8% of HIV-positive pregnant women had benefited from these therapies. The average percentage of infants who were perinatally infected during the 1984-2000 period (33.9%) was approximately 6 times greater than the average percentage infected between 2001 and 2008 (5.2%).⁴

Perinatal exposure antiretroviral therapy, and seroconversion of infants in Canada

Between 1984 and 2008, 80.4% of the 2,851 infants known to have been perinatally exposed to HIV were confirmed not infected. Since the World Health Organization first issued recommendations for the use of ARV drugs to prevent mother-to-child transmission in 2000, both the number and proportion of HIV-positive pregnant women receiving ART in Canada has increased (Figure 1). In 2000, 77.9% of known HIV-positive pregnant women were receiving any ART. By 2008, the rate was 87.8%. Moreover, between 1984 and 2008, the proportion of HIV-positive pregnant women who received ART during the perinatal period and whose infants were confirmed to be infected (1.6%) was significantly lower than of those who did not receive ART (47.9%).⁴

Figure 1. Perinatal exposure to HIV, antiretroviral therapy, and confirmed HIV infections among infants, by year

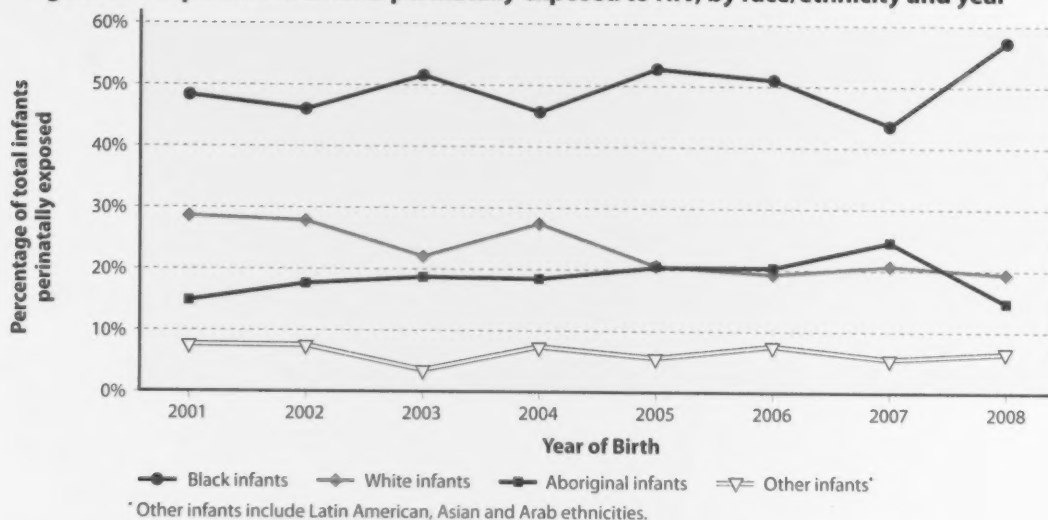


Perinatal HIV Transmission Trends

Race/ethnicity

Between 1984 and 2008, 2,851 births were reported in which an infant was perinatally exposed to HIV; 97.5% of these cases included information on ethnicity/race.⁴

Figure 2. Proportion of infants perinatally exposed to HIV, by race/ethnicity and year



Key points:

- The average proportion of white infants perinatally exposed to HIV between 2001 and 2008 (22.9%) was less than during the period 1984-2000 (35.9%) and has generally shown a downward proportional trend since 2001 (Figure 2).
- Between 1984 and 2008, black infants accounted for the largest proportion of infants perinatally exposed to HIV: 1,333 cases out of a total of 2,851 (46.8%). This proportion has increased over time, from 43.2% in 1984-2000 to 49.8% in 2001-2008 (Figure 2).
- While Black infants were the largest group of perinatally infected infants from 1984 to 2008 (286 confirmed HIV infections), the seroconversion rate among Black infants perinatally exposed to HIV has decreased dramatically, from 15% in 2001, to 0% in 2007 and 1.5% in 2008 (Figure 3).
- Between 1984 and 2008, Aboriginal infants were overrepresented among all infants perinatally exposed to HIV (16.2%), as well as among infants confirmed infected (9.5%); according to the 2006 census Aboriginals make up 3.8% of the total Canadian population.⁵

HIV Screening of Pregnant Women in Canada

Each province and territory determines which approach it will use to screen pregnant women for HIV (Table 1). The two systems currently in use are voluntary screen-

ing (opt-in) or routine screening with right of refusal (opt-out). The Canadian Medical Association recommends voluntary screening since a positive result can have an impact on many different aspects of a person's life.⁸ However, routine screening with right of refusal reaches a larger proportion of pregnant women.

Table 1. Approach to HIV screening of pregnant women by province/territory

Province/territory	Testing approach*	Year
British Columbia	Opt-in	1994
Yukon	Opt-in	1994
Northwest Territories	Opt-out	1993, revised in 1998
Nunavut	Opt-out	1999
Alberta	Opt-out	1998
Saskatchewan	Opt-out	1999, revised in 2004-2005
Manitoba	Opt-out	2002, revised in 2006
Ontario	Opt-in	1999
Quebec	Opt-out	2002
New Brunswick	Opt-out	1999, revised in 2005
Nova Scotia	Opt-in	1998
Prince Edward Island	Opt-in	1999
Newfoundland and Labrador	Opt-out	1992, revised in 1994

*According to data submitted by provincial/territorial HIV/AIDS data coordinators.

According to prevalence studies among pregnant women in several provinces, the HIV prevalence rates between 1998 and 2008 in this group ranged from 2 to 9 per 10,000, but rates are not available for

all provinces and territories. Table 2 presents the percentage of pregnant women screened for HIV virus in several provinces.

Table 2. Available data on HIV screening rates among pregnant women, by province

Province/territory	Percentage of pregnant women screened for HIV
British Columbia	83.4% in 2003 ⁹
Alberta	97.0% in 2006 ¹⁰
Ontario	97.6% in 2009 ¹¹

Overview of Recent Research

Antiretroviral therapy research and adherence

Despite significant progress made in ART to prevent perinatal HIV transmission, research efforts to improve these therapies and treatment adherence continue. Research efforts prevent perinatal HIV transmission, as well as study factors that contribute to treatment adherence.

- A study investigating the superiority of Kaletra-based highly active ART (HAART) over regimens that use nevirapine and zidovudine was conducted in 2009.¹³ To perform their comparison, the researchers collected data on all pregnant women who had received three-drug HAART between 1994 and 2007. The authors concluded that there was no link between the HAART regimen selected and the level of viral suppression achieved in patients. They also determined that other variables, such as CD4 cell counts and viral loads before the start of therapy, as well as adherence to and duration of treatment, have a greater influence over the success of HAART than the product selected.
- Data were collected on 195 HIV-positive mothers and their babies from 21 different pediatric centres in Canada in 2007.¹⁴ Analysis revealed that 82.6% of the mothers had received HAART, 4.1% had received some form of ART, and 13.3% had received no treatment. Only one infant in the group, born of a mother who had received no treatment, was confirmed to be infected.

- Researchers studied the records of 193 British Columbia women who were given HAART between 1993 and 2006, in order to determine their level of adherence before and after giving birth.¹⁵ The study participants were significantly more likely to adhere to their treatment regimens during pregnancy relative to postpartum. Adherence was also positively associated with a low CD4 cell count before treatment and residence in the Vancouver Coastal Health Authority area.

Intention of HIV-positive women to have children

- The roll-out of highly effective treatments has increased the odds that a woman living with HIV can deliver a healthy baby by reducing the risk of mother-to-child transmission. This advance has resulted in more HIV-infected women intending and/or choosing to have children. Adherence to ART plays an extremely important role in reducing viral count in pregnant women, an important factor in treatment outcome.
- In a survey of 182 HIV-positive women of reproductive age conducted in British Columbia between November 2003 and December 2004, 25.0% of the women indicated that they wanted to have children.¹⁶ Younger women, respondents in a stable relationship, and women of non-Aboriginal descent were more likely to report intention to have children. Overall, respondents' reported intention to have children that approached the same levels observed among women in the general population.

- A study of HIV-positive women of reproductive age (18-52 years) living in Ontario was carried out between October 2007 and April 2009.¹⁷ The median age of the 490 women in the study was 38, and 74.0% of the women were receiving ART at the time of the study. The study found that 69.0% of the women wanted to have children, and 57.0% fully expected to conceive one day.

Pregnant women of Aboriginal descent and immigrants from HIV-endemic countries disproportionately affected

Geographic origin, poverty, and social marginalization are some of the major factors influencing one's risk of contracting a communicable disease. The increased immigration to Canada from HIV-endemic regions of the world contributes to Canada's growing number of people living with HIV/AIDS, including pregnant women, children and infants.

Between 1984 and 2008, 205 infants confirmed to be infected with HIV were born in Ontario. Of this number, 133 (68.6%) were born to mothers from countries where HIV is endemic.¹⁹

The rising number of HIV cases among Aboriginals also translates into rising numbers of Aboriginal women of reproductive age who are living with HIV.

Blood specimens were taken from 5,232 pregnant Aboriginal women in British Columbia during the years 2000 to 2003.¹⁸ Testing of these samples revealed an HIV prevalence rate among these women that was 7 times higher than the estimated rate of the general population during that same time period.

Comment

Although there has been a decline in the rate of mother-to-child transmission of HIV, the absolute number of infants exposed to HIV *in-utero* or during birth is on the rise. It is thus important that all pregnant women, as well as women considering pregnancy, continue to have access to prenatal care that includes the offer of HIV testing, HAART, and appropriate counselling and care.

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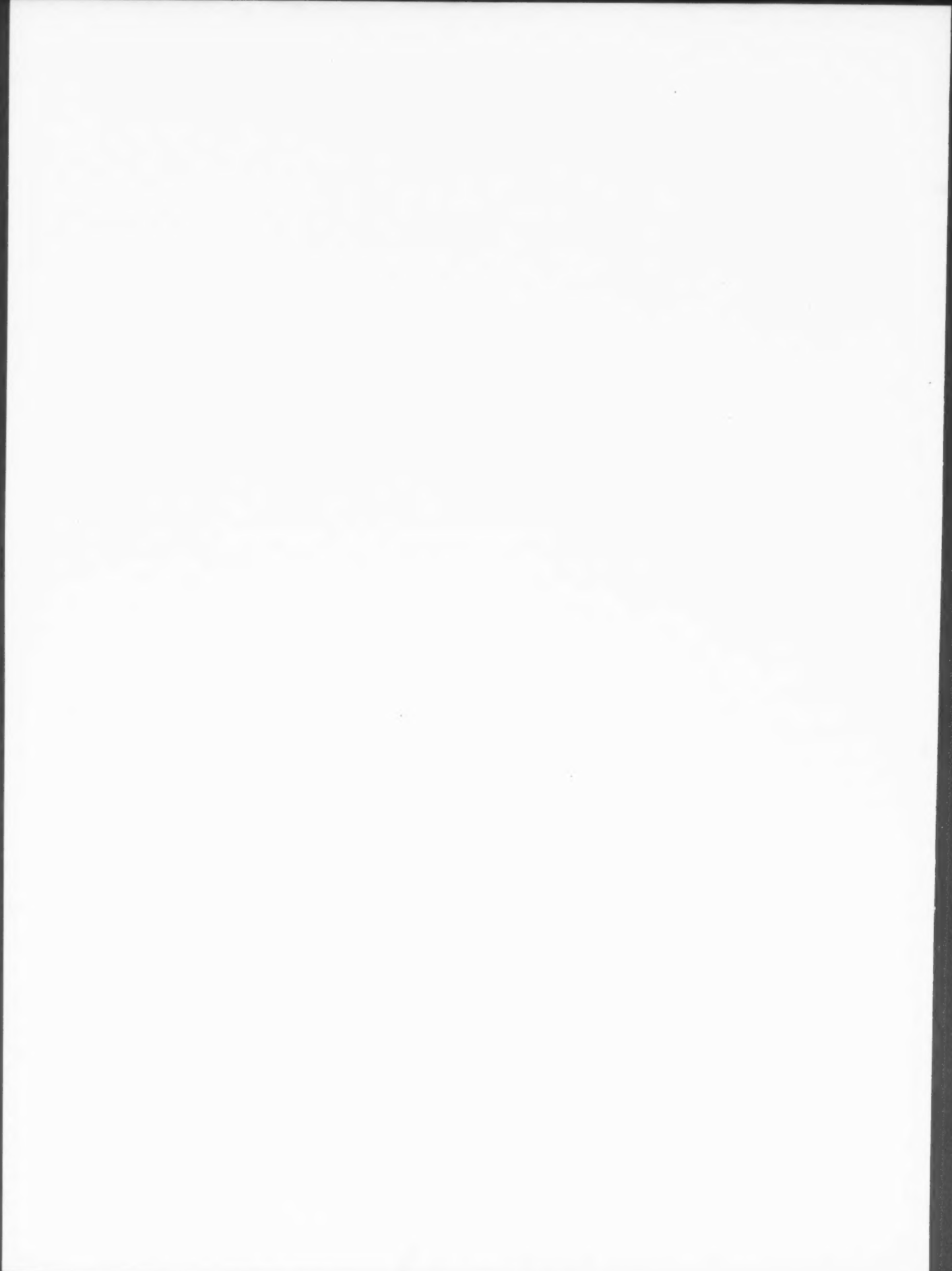
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Public Health Agency of Canada

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HIV/AIDS Among Aboriginal People in Canada

At a Glance

- Aboriginal people remain overrepresented in the HIV/AIDS epidemic in Canada.
- Among Aboriginal Canadians, the estimated proportion of new HIV infections in 2008 attributed to the IDU exposure category (66%) was much higher than among all Canadians (17%).
- HIV/AIDS has a significant impact on Aboriginal women in particular. During 1998-2008, women represented 48.8% of all positive HIV test reports among Aboriginal people as compared with 20.6% of reports among those of other ethnicities.
- The age at HIV diagnosis for Aboriginal people tends to be lower than for people of other ethnicities. Almost a third (32.6%) of the positive HIV test reports from 1998 to the end of 2008 among Aboriginal people were youth aged 15-29, as compared with 20.5% among those of other ethnicities.

Introduction

In Canada, Aboriginal populations are very diverse, with communities (First Nations, Métis and Inuit) that reflect unique historical backgrounds, languages and cultural traditions. According to data on self-identified ethnicity from the 2006 Census, 1.2 million people identified themselves as "Aboriginal", constituting 3.8% of the Canadian population in 2006. The number of people in Canada who reported having some Aboriginal ancestry^{*} was 1.7 million. About 60% of the Aboriginal population identified themselves as First Nations, 33% as Métis, 4% as Inuit and 3% as Other or as a combination of Aboriginal identities. Eight in 10 Aboriginal people lived in Ontario and the four western provinces, and around 54% lived in urban areas.¹ However, these numbers may underestimate the actual Aboriginal population, as 22 Indian reserves and settlements did not participate in the 2006 Census, and it is likely that others may have chosen not to self-identify to government workers. Aboriginal communities are disproportionately affected by many social, economic and behavioural factors, such as high rates of poverty, substance abuse, sexually transmitted infections and limited access to, or use of, health care services, all of which increase their vulnerability to HIV infection.

This report updates current information on the status of the HIV/AIDS epidemic among Aboriginal people in Canada. Wherever possible, in the summaries of Canadian HIV and AIDS surveillance data Aboriginal people are identified as First Nations, Inuit or Métis. The category "Aboriginal Unspecified" is also used if no further details are known.

The findings in this report are presented as emergent themes with supporting information from routine surveillance systems, enhanced surveillance systems and published research. National HIV and AIDS surveillance data that appear in this document are from both (a) *HIV and AIDS in Canada. Surveillance Report to December 31, 2008*¹ and (b) unpublished data from the Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control (CCDIC), Public Health Agency of Canada (PHAC).

^{*}"Aboriginal ancestry" refers to the ethnic or cultural origin of a person's ancestors, an ancestor being usually more distant than a grandparent. In the 2006 Census, if a person reported at least one Aboriginal ancestry response, the person was counted in the Aboriginal ancestry population.



National Estimates of HIV Prevalence and Incidence

PHAC uses multiple methods to provide an overall picture of the HIV epidemic among all Canadians living with HIV (including AIDS), both diagnosed and undiagnosed. Using these combined methods, PHAC produces two types of estimate: prevalence, the number of people living with HIV (including AIDS), and incidence, the number of new infections in a 1-year period. PHAC produces estimates of national HIV prevalence and incidence approximately every 3 years. Please refer to Chapter 1 for a full description of national HIV prevalence and incidence estimates for 2008.

- Aboriginal people continue to be overrepresented in the HIV epidemic in Canada. They represented 3.8% of the Canadian population according to the 2006 Census,² and yet an estimated 4,300 to 6,100 Aboriginal people were living with HIV (including AIDS) in Canada in 2008 (8.0% of all prevalent HIV infections). This represents an increase of 24% from the 2005 estimate of 3,500 to 4,900 (7.4% of all prevalent infections in 2005).
- Aboriginal people accounted for an estimated 300 to 520 new HIV infections in 2008 (12.5% of all new infections), higher than the corresponding figure for 2005, of 240 to 430 (10.5% of all estimated new infections). These proportions for 2008 are much higher than the proportion of Aboriginal people in the general Canadian population. Furthermore, the estimated new infection rate among Aboriginal people was about 3.6 times higher than among non-Aboriginal people in 2008.³
- The estimated distributions of exposure categories of incident infections among Aboriginal people in 2005 and 2008 are indicated in Table 1. The proportion of estimated new HIV infections in 2008 among those who inject drugs (IDU) in this population (66%) was much higher than among all Canadians (17%).³ This highlights the uniqueness of the HIV epidemic among Aboriginal people and underscores the complexity of Canada's HIV epidemic.
- In terms of the estimated number of new infections among Aboriginal people by exposure category, a slight increase attributed to IDU was also estimated in 2008, which is related to the recently reported increase in new HIV diagnoses among IDU in Saskatchewan.

Table 1. Distribution of exposure category for estimated incident HIV infections among Aboriginal people in Canada

Exposure category	Year 2005 (n = 240-430)	Year 2008 (n = 300-520)
IDU	63%	66%
Heterosexual contact	24%	23%
MSM	11%	9%
MSM/IDU	2%	2%

IDU: people who inject drugs; Heterosexual contact: people born in a country where HIV is endemic, people who report heterosexual contact with a person who is either HIV-infected or at increased risk of HIV infection, and people who report heterosexual contact as the only risk factor; MSM: men who have sex with men.

Routine Surveillance

The CCDIC collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, death data are also collected.

Health care providers and/or laboratories forward this information to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS diagnoses to the Centre, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, underreporting, missing information and individuals with undiagnosed infection.

(Please refer to Chapter 3 for a full description of HIV/AIDS surveillance in Canada.)

Note regarding reporting of ethnicity information

An adequate description of the HIV/AIDS epidemic among Aboriginal people in Canada requires accurate and complete access to ethnicity data about AIDS cases and positive HIV test reports. Of all AIDS cases reported between 1979 and December 31, 2008, 79% included ethnicity data. For new positive HIV test reports from 1998 (when ethnicity reporting began) to the end of 2008, ethnicity data are reported for 29.8% of records and are not available for all provinces and territories. Provinces and territories that report ethnic information with their HIV reports are British Columbia, Yukon, Alberta, Northwest Territories, Nunavut, Saskatchewan, Manitoba, New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. As a result, only data from these provinces and territories are used when examining positive HIV test data on Aboriginal people.

In the provinces/territories that provide race/ethnicity information with positive HIV test reports, data on self-identified ethnicity from the 2006 Census indicate that Aboriginal people make up 6.9% of their overall population, with concentrations in the Territories (Yukon, Northwest Territories and Nunavut 25.0%, 49.8% and 84.5% of the respective populations) and other western provinces, such as Saskatchewan (14.7%) and Manitoba (15.3%).¹ Ethnic information on positive HIV test reports is well reported for all of these provinces/territories. However, the 2006 Census data also indicate that Ontario and Quebec, provinces that do not provide ethnic information with their positive HIV test reports, account for 29.9% of Canadians who self-identified as Aboriginal (i.e. 350,925 of 1,172,790), and this represents 1.8% of the population of these provinces (i.e. 350,925 of 19,706,413).²

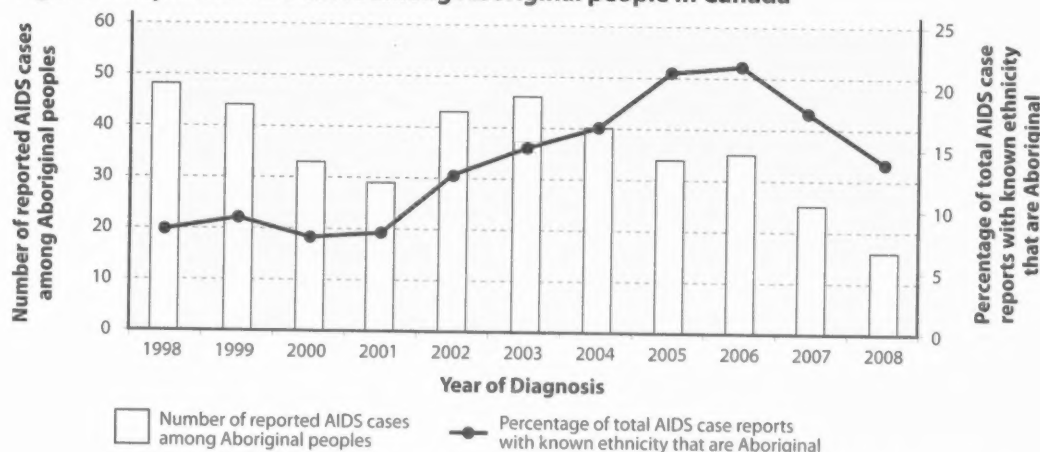
AIDS surveillance data summary

Between 1979 and December 31, 2008, there were 21,300 AIDS cases reported to CCDIC. Of these, 16,824 (79.0%) included information on ethnicity, of which 690 (4.1%) were reported to be Aboriginal people.

In 2008, ethnicity data were available for 45.1% of reported AIDS cases. This decline in data completeness was in part due to a change in an information technology application in Ontario, where information on ethnicity and exposure category was not available for AIDS cases reported after the second half of 2005. When interpreting data for 2005-2008, caution must be used because of small numbers.

Between 1979 and 1998, there were 14,026 reported AIDS cases with information on ethnicity, and 345 of these, or 2.4%, were from Aboriginal people. Figure 1 shows that in 1998 the number of reported AIDS cases in this population constituted 8.2% of the reported AIDS cases with known ethnicity, and this proportion increased to 9.1% in 1999 before a decline was noted. In 2002, the proportion increased to 12.9% and then steadily increased, rising to 21.7% in 2006. Although there are some limitations associated with the data from Ontario and Quebec for more recent years, in 2008 Aboriginal people accounted for 13.9% of the total reported AIDS cases for which ethnicity was known.

Figure 1. Reported AIDS cases among Aboriginal people in Canada



* Quebec AIDS data by ethnicity have not been available since June 30, 2003, and Ontario AIDS data by exposure category and ethnicity have not been available since the second half of 2005.

Exposure category

People who inject drugs (IDU) continue to represent a significant exposure category in the Canadian HIV epidemic. Trends observed in surveillance data suggest that injecting drug use is a particularly important risk factor for HIV and AIDS among Aboriginal people and accounts for more HIV infections and AIDS cases among Aboriginal women than Aboriginal men.

As Table 2 indicates, there are notable differences in exposure categories between Aboriginal and non-Aboriginal HIV and AIDS case reports. Although the proportion attributed to heterosexual contact exposure is similar, Aboriginal people have a higher proportion of reports attributed to IDU and a smaller proportion to MSM.

Table 2. Comparison of selected exposure categories for reported AIDS cases and positive HIV test reports* among Aboriginal and non-Aboriginal people

	Aboriginal	Non-Aboriginal
	<i>n</i> = number of cases with available information on exposure category and ethnicity	
AIDS diagnoses 1979-2008	<i>n</i> = 664	<i>n</i> = 15,716
MSM	27.1%	68.1%
MSM/IDU	7.2%	4.5%
IDU	42.2%	7.5%
Heterosexual	20.5%	15.8%
Perinatal	1.2%	1.0%
Other	1.8%	3.1%
Positive HIV test reports 1998-2008	<i>n</i> = 1,843	<i>n</i> = 5,838
MSM	6.5%	39.9%
MSM/IDU	3.3%	2.8%
IDU	60.0%	23.4%
Heterosexual	28.4%	31.7%
Perinatal	0.5%	0.4%
Other	1.2%	1.7%

MSM: men who have sex with men; MSM/IDU: individuals self-reporting both MSM and IDU; IDU: people who inject drugs; Other: recipient of blood/clotting factor, occupational exposure and Other.

*For positive HIV test reports, the data are from provinces/territories with reported ethnicity.

Note: Percentages rounded to one decimal point.

- Of reported AIDS cases with known exposure, the proportion of Aboriginal cases attributed to injecting drug use has increased over time, from 18.0% before 1995 to 48.6% during 1995-2000 to over 50% during 2001-2008, for an overall 42.2% of reported AIDS cases among Aboriginal people over the years 1979 to 2008.
- Of the 664 reported AIDS cases with known exposure category among Aboriginal people between 1979 and December 31, 2008, there were 472 male cases and 192 female cases. Of female reports, 64.6% were attributed to IDU and 32.8% to heterosexual exposure, and of male reports 38.1% were attributed to MSM, 33.1% to IDU, 10.2% to MSM/IDU and 15.5% to heterosexual exposure. Figures 2a and 2b display how these cases were distributed by exposure category in males and females respectively.

Figure 2a. Distribution of exposure categories of reported AIDS cases among Aboriginal males ($n = 472$), November 1979 to December 31, 2008

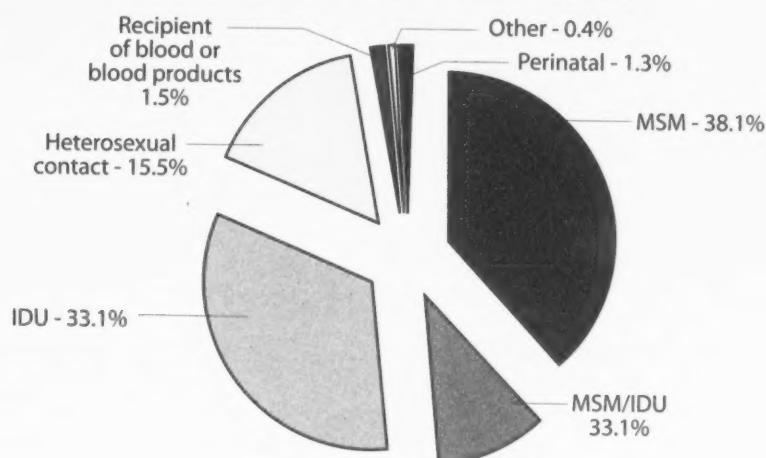
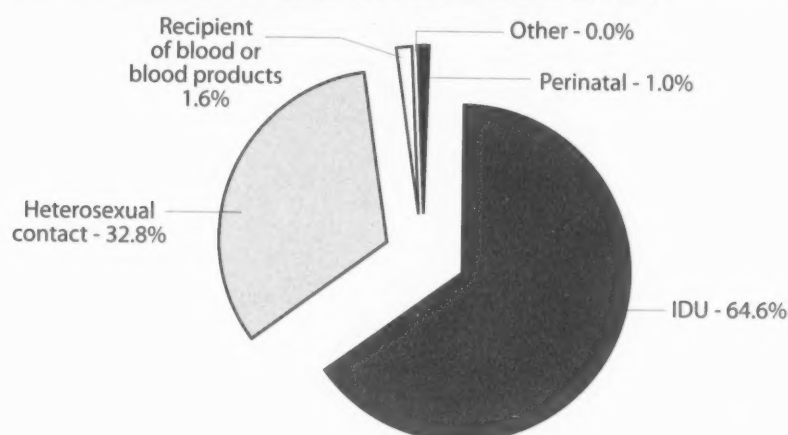


Figure 2b. Distribution of exposure categories of reported AIDS cases among Aboriginal females ($n = 192$), November 1979 to December 31, 2008



Sex

In contrast to HIV and AIDS cases in the non-Aboriginal population, females make up a comparatively large portion

of the Aboriginal HIV epidemic. Table 3 shows the distribution of sex in reported AIDS cases and positive HIV test reports for Aboriginal and non-Aboriginal people.

Table 3. Comparison of sex of reported AIDS cases and positive HIV test reports* among Aboriginal and non-Aboriginal people

	Aboriginal	Non-Aboriginal
<i>n</i> = number of cases with available information on sex and ethnicity		
AIDS diagnoses, 1979-2008	<i>n</i> = 689	<i>n</i> = 16,131
Female	29.0%	9.1%
Positive HIV test reports, 1998-2008	<i>n</i> = 1,886	<i>n</i> = 5,975
Female	48.8%	20.6%

* For positive HIV test reports, the data are from provinces/territories with reported ethnicity.

- Before 1998, females represented 19.2% of reported AIDS cases with known sex among Aboriginal people (57/297), and this has ranged from 36.5% between 1998 and 2008 to a high of 50.0% in 2008.
- Between 1979 and 2008, females made up 29.0% of reported AIDS cases among Aboriginal people, as compared with 9.1% of female cases among non-Aboriginal people for that same period. Since 2001, females represented above 30.0% of reported AIDS cases among Aboriginal people every year to 2008.

Age

HIV and AIDS among young people in Aboriginal communities is an increasing concern. Understanding the epidemic in this group will help target early intervention strategies appropriately; however, caution should be used when reviewing proportions by age group, as they can change considerably with the addition of only a few cases, particularly when total numbers are small, as in the case of youth (15-29) or children (14 and under).

As indicated in Table 4, among positive HIV test reports and reported AIDS diagnoses, Aboriginal cases tended to be younger than non-Aboriginal cases.

Table 4. Age group comparison for HIV and AIDS case reports among Aboriginal and non-Aboriginal people*

	Aboriginal	Non-Aboriginal
<i>n</i> = number of cases with available information on age and ethnicity		
Reported AIDS diagnoses 1979-December 31, 2008	<i>n</i> = 690	<i>n</i> = 16,134
< 15 years	1.2%	1.2%
15-19 years	0.1%	0.3%
20-29 years	19.1%	14.5%
30-39 years	45.2%	43.4%
40-49 years	25.7%	28.5%
50-59 years	6.7%	8.9%
60+ years	2.0%	3.2%
Positive HIV test reports 1998-December 31, 2008	<i>n</i> = 1,891	<i>n</i> = 5,986
< 15 years	0.8%	0.6%
15-19 years	4.8%	1.0%
20-29 years	27.9%	19.6%
30-39 years	36.0%	35.8%
40-49 years	23.4%	27.6%
50-59 years	7.2%	15.4%

* For positive HIV test reports, the data are from provinces/territories with reported ethnicity.

Note: Percentages rounded to one decimal point.

Between 1979 and 2008, 19.3% of reported AIDS cases among Aboriginal people were between 15 and 29 years old, compared with 14.8% of reported AIDS cases among non-Aboriginal people in the same age group.

The MSM and IDU exposure categories accounted for a large proportion of AIDS cases reported from 1979 to the end of 2008 among Aboriginal people aged 15-29. At 43.8%, the IDU exposure category represented the largest proportion of cases, and this was followed by MSM at 28.5% and then the heterosexual exposure category at

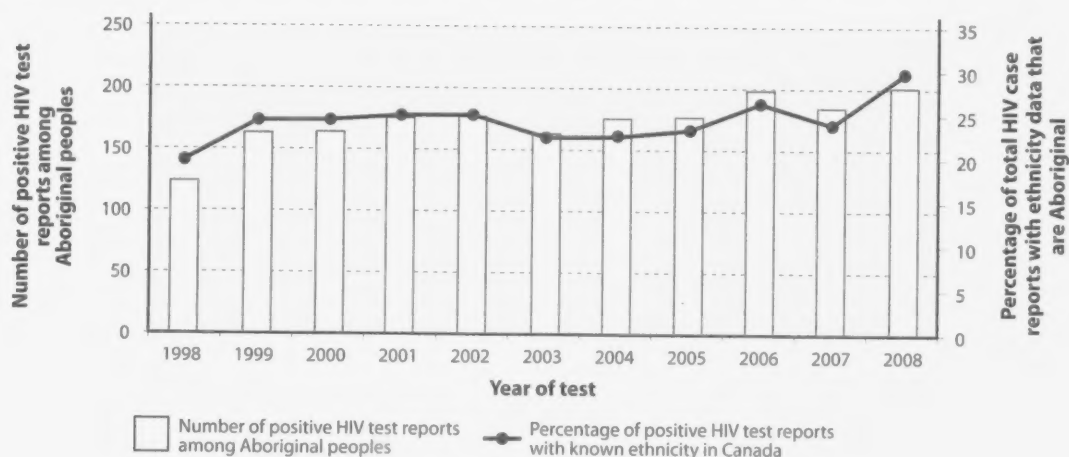
13.8%. A somewhat similar pattern was observed among Aboriginal people aged 30 to 39 years. The distribution of AIDS reports by exposure category differed with older age groups, heterosexual exposure accounting for a larger proportion of reports. Among Aboriginal people aged 40 to 49 years, IDU exposure accounted for 44.0% of reports, heterosexual exposure for 29.2% and MSM exposure for 19.6%. Among Aboriginal people aged 50 years or more, heterosexual exposure accounted for 44.6% of reports, IDU exposure for 28.6% and MSM for 21.4%.

HIV surveillance data summary

Between 1998 and the end of December 2008, there were 26,408 positive HIV tests reported to CCDIC, 7,880 of which contained information on ethnicity (29.8%). Of these 7,880, there were 1,892 positive test reports identified from Aboriginal people (24.0%). As ethnicity data for positive HIV test reports have only been available since 1998, comparisons are only possible for this limited period of time.

Figure 3 shows that since 1999 the proportion of positive HIV test reports attributed to Aboriginal people has remained somewhat steady, at over 20%. Of the 644 positive HIV tests reported for 1998 by provinces and territories with ethnicity reporting, 123 were among Aboriginal people, representing 19.1% of such tests reported in that period. This proportion was 24.8% (176/710) in 2002, following which a slight decrease was noted. However, in 2006 the proportion of positive HIV test reports attributed to Aboriginal people increased to 26.2% and in 2008 to 29.4% among the provinces and territories reporting ethnicity information with their HIV reports.

Figure 3. Positive HIV test reports among Aboriginal people in Canada*



Exposure category

- A review of positive HIV test reports between 1998 and 2008 indicates that injection drug use was the most common identified route of transmission among Aboriginal people, accounting for 60.0% of reports in this population.
- Of the 1,843 positive HIV test reports with known exposure category reported among Aboriginal people between 1998 and December 31, 2008, there were 945 male cases and 893 female cases (information on sex was missing for five cases). Figure 4a displays the distribution of exposure categories among males: 12.6% were attributed to MSM, 54.4% to IDU and 24.7% to heterosexual contact. Of female reports (summarized in Figure 4b), 65.8% were attributed to IDU and 32.5% to heterosexual contact, proportions similar to those of reported AIDS cases.
- There is a substantial difference between Aboriginal people and the general Canadian population in the injection drug use exposure category. In 2008, 63.6% of positive HIV test reports with known exposure category reported among Aboriginal people were attributed to injection drug use, compared with just 11.3% among non-Aboriginal Canadians.

Figure 4a. Distribution of exposure categories of positive HIV test reports among Aboriginal males ($n = 945$), January 1998 to December 31, 2008

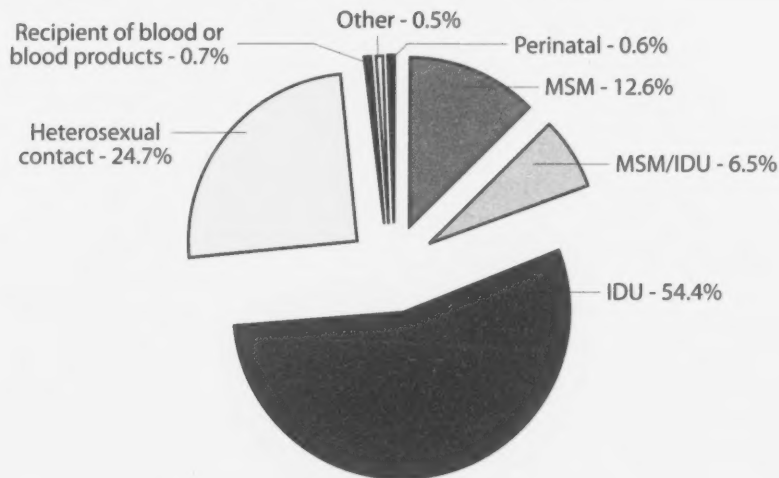
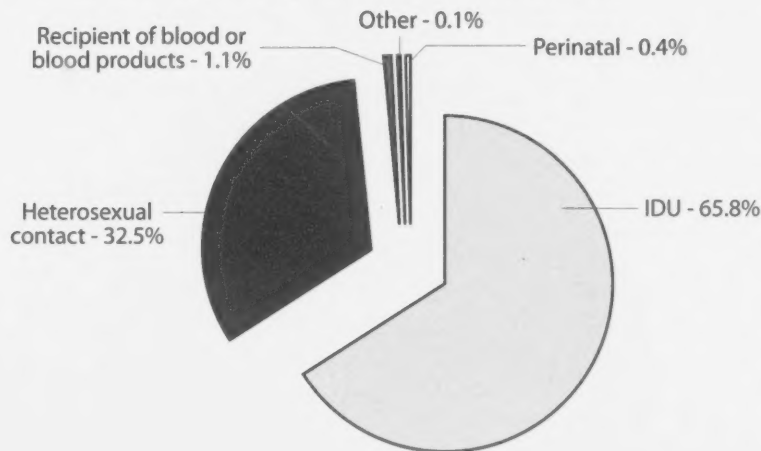


Figure 4b. Distribution of exposure categories of positive HIV test reports among Aboriginal females ($n = 893$), January 1998 to December 31, 2008



Sex

- Of positive HIV test reports with known sex among Aboriginal people, the proportion attributed to females ranged from 43.0% to 52.8% between 1998 and 2008, with a high of 56.6% (99/175) in 2005.
- Between 1998 and 2008, females made up nearly half (48.8%) of all positive HIV test reports among Aboriginal people, whereas only 20.6% of positive HIV test reports were reported among non-Aboriginal females for the same period.

Age

Between 1998 and 2008, almost one-third (32.6%) of Aboriginal people with a diagnosis of HIV infection were youth aged 15-29, compared with 20.5% of HIV-positive tests among non-Aboriginal people in the same age group.

Aboriginal people aged less than 40 years accounted for a greater proportion of HIV test reports (69.5%) from 1998 to the end of 2008 than people of other ethnicities (Table 4). The proportion of positive HIV test

reports from this period among Aboriginal people aged 15-29 (32.6%) differs from the proportion among non-Aboriginal people in the same age group (20.5%). The IDU exposure category accounted for 64.7% of HIV test reports among Aboriginal youth between 15 and 29 years of age, heterosexual exposure accounted for 25.1% and MSM exposure for 6.4%. Somewhat similar distributions were noted for test reports among Aboriginal people aged 30 to 49, IDU exposure accounting for 60.8% of HIV test reports, heterosexual exposure for 28.1% and MSM for 6.2%. Among Aboriginal people aged 50 years or more the distribution of HIV reports changes, heterosexual exposure accounting for 48.5%, IDU exposure for 36.2% and MSM for 9.2%.

HIV/AIDS Surveillance Data in Canada's Three Aboriginal Communities

When compared with non-Aboriginal communities, the number of positive HIV test reports and reported AIDS cases in Aboriginal communities may appear small; however, it is important to understand that these are individual cases, and every new diagnosis has a significant impact on the total counts for an Aboriginal community. Caution should be used when reviewing community proportions, as they can change considerably with the addition of only a few cases, particularly when total numbers are small.

Table 5. Sex, age groups, and exposure categories of reported AIDS cases in Aboriginal groups in Canada between 1979 and December 31, 2008

	First Nations	Métis	Inuit	Aboriginal, unspecified
<i>n</i> = number of cases with available information on age and ethnicity				
Sex	<i>n</i> = 502	<i>n</i> = 52	<i>n</i> = 22	<i>n</i> = 113
Female	29.9%	19.2%	40.9%	27.4%
Age (years)	<i>n</i> = 503	<i>n</i> = 52	<i>n</i> = 22	<i>n</i> = 113
< 15 years	1.0%	1.9%	0.0%	1.8%
15-19 years	0.2%	0.0%	0.0%	0.0%
20-29 years	18.7%	30.8%	31.8%	13.3%
30-39 years	45.5%	34.6%	54.5%	46.9%
40-49 years	25.0%	28.8%	9.1%	30.1%
50-59 years	7.8%	1.9%	0.0%	5.3%
60+ years	1.8%	1.9%	4.5%	2.7%
Exposure category	<i>n</i> = 482	<i>n</i> = 51	<i>n</i> = 22	<i>n</i> = 109
MSM	23.7%	43.1%	27.3%	34.9%
MSM/IDU	7.7%	5.9%	4.5%	6.4%
IDU	47.5%	29.4%	31.8%	26.6%
Heterosexual	18.5%	17.6%	31.8%	28.4%
Perinatal	1.0%	2.0%	0.0%	1.8%
Other	1.7%	2.0%	4.5%	1.8%

AIDS surveillance data

According to the 2006 Census, 60% of Aboriginal people in Canada self-identified as First Nations, 33% as Métis, 4% as Inuit and another 3% as being from multiple communities.¹ Data suggest that First Nations people are overrepresented among reported Aboriginal AIDS cases. Of the 690 Aboriginal AIDS cases reported up to the end of 2008, 503 (72.9%) were among First Nations, 52 (7.5%) among Métis, 22 (3.2%) among Inuit and 113 (16.4%) were in the category Aboriginal Unspecified.

The data on reported AIDS cases in terms of exposure categories, females and youth in specific Aboriginal communities and in the Aboriginal Unspecified category are summarized in Table 5. The figures demonstrate that the proportions of female Aboriginal AIDS cases are different for First Nations, Inuit and Métis.

First Nations

Of the AIDS case reports to date, a majority (47.5%) of those self-identified as First Nations were attributed to the injecting drug use exposure category (229/482) and 23.7% to the MSM category (114/482). Females represented 29.9% of reported cases (150/502), compared with 9.1% of reported AIDS cases among non-Aboriginal people. Youth (aged 15-29) accounted for 18.9% of all First Nations cases (95/503), compared with 14.8% of reported cases among non-Aboriginal youth. Moreover, people aged 50 and older made up 9.6% of reported AIDS cases among First Nations people.

Métis

Of self-identified Métis people in the AIDS case reports to date, a majority (43.1%, 22/51) were attributed to the MSM exposure category and 29.4% (15/51) to the IDU exposure category. Females represented 19.2% of reported cases (10/52), compared with 9.1% of reported cases among non-Aboriginal people. It was noted that 30.8% of reported AIDS cases (16/52) among the Métis were in individuals between 15 and 29 years of age, compared with 14.8% of reported cases among non-Aboriginal youth. Those aged 50 and older made up 3.8% of reported AIDS cases among Métis people.

Inuit

Among self-identified Inuit people in the AIDS case reports to date, the most common exposure categories were IDU and heterosexual contact, accounting for 31.8% each of reports (7/22). A notable proportion of cases were female (9/22 or 40.9%), compared with 9.1% of reported cases among non-Aboriginal people.

Youth (15-29 years) represented 31.8% of cases (7/22), compared with 14.8% of reported cases among non-Aboriginal youth. Those aged 50 and older made up 4.5% of reported AIDS cases among Inuit people.

Aboriginal unspecified

Among those for whom the Aboriginal community was unspecified in the AIDS case reports, the MSM exposure category accounted for the largest proportion of cases, at 34.9% (38/109), and both the heterosexual and IDU exposure categories accounted for large proportions, at 28.4% (31/109) and 26.6% (29/109) respectively. Females constituted 27.4% of cases (31/113), compared with 9.1% of reported cases among non-Aboriginal people. Youth (15-29 years) made up 13.3% of cases (15/113), compared with 14.8% of reported cases among non-Aboriginal youth.

Summary of Recent Research on HIV Prevalence and Risk Behaviours Among Aboriginals

Injection drug use continues to be a key mode of transmission in the Aboriginal community

Aboriginal people are overrepresented in the IDU population and are at even higher risk than other members of this high-risk population.

- The CEDAR Project (2003-2005) found an HIV prevalence of 8.5% (46/543) among Aboriginal youth aged 14-30 years who used injection and non-injection drugs in two urban centres in British Columbia.⁴ The study also reported a prevalence of hepatitis C virus (HCV) infection of 59.4% at enrolment among those who injected drugs.⁵
- In a study of Calgary's Needle Exchange Program, most participants were White (75%), but Aboriginal people were the second highest ethnic/racial group, representing 20% of total participants.⁶
- The Vancouver Injection Drug Users Study (VIDUS) is an open cohort of IDUs. Of the 1,400 recruited between May 1996 and May 2000, 25% were Aboriginal people, more than half of whom were female (54% female, 46% male). In contrast, females accounted for 29% of non-Aboriginal participants.⁷ The VIDUS investigators found that Aboriginal status was significantly associated with new HIV infection in both men and women⁸ and also with age of 24 years or younger.⁹

- VIDUS reported that, as of December 2001, 19.1% of Aboriginal participants had seroconverted, compared with 9.6% of people who identified themselves as non-Aboriginal.¹⁰ In a 2003 publication, the investigators found that the incidence of HIV among Aboriginal IDUs was considerably higher than among their non-Aboriginal counterparts, and about half of the Aboriginal IDUs were women; they concluded that, in Vancouver, Aboriginal IDUs were becoming HIV positive at twice the rate of non-Aboriginal IDUs.¹¹
- Furthermore, the VIDUS investigators found that 16% of young IDUs (78/479) aged 29 or younger were coinfecting with HIV and HCV at baseline, and 45% (35/78) of these were Aboriginal. Of participants who returned for follow-up, a further 15% became coinfecting during the study, and about 45% of the seroconverters were Aboriginal participants. The median number of years' injecting for youth who seroconverted to a secondary infection was 3 years.¹² Further examination of the VIDUS data for young IDUs (aged 13-24 years) revealed that 27% of the youth (80/291) were Aboriginal, and they were more likely than non-Aboriginal youth to test seropositive for HIV and HCV at baseline.¹³ Also, young participants aged 13-24 years who injected drugs were more likely to be female and to be engaged in commercial sex work or have casual sexual partners.¹⁴
- Of 910 MSM surveyed in Vancouver between 1995 and 2000, 106 (12%) had injected drugs in the previous year. MSM/IDU were younger than MSM and more likely to be HIV seropositive, Aboriginal, economically disadvantaged, engaged in the trade of sex for money and drugs, and to report having female partners.¹⁵
- In a prenatal HIV screening program study conducted in Alberta of 38,712 pregnant women, 2,549 (6.6%) were First Nations and 36,163 (93.4%) were women of other ethnicities. A total of 593 pregnant women (1.5%) declined HIV testing: 55 First Nations women (2.2%) and 538 women of other ethnicities (1.5%). Overall, the pregnant women of First Nations were on average about twice as likely to decline HIV testing as pregnant women of other ethnicities, particularly when they were under the care of male practitioners.¹⁸
- Despite high numbers of Aboriginal women seen at HIV clinics and pediatric centres, during the period from 1995 to 1997 pregnant Aboriginal women were as likely to be taking antiretroviral therapy (62%) as pregnant White women (66%) and pregnant Black women (63%).¹⁹
- In a 2001 study of antiretroviral therapy in a cohort of HIV-positive pregnant women recruited at seven sites in Ontario, Manitoba and Saskatchewan, 20% of women were Aboriginal. Late use of antiretroviral therapy (in third trimester or intrapartum) was unequally distributed by ethnic/racial status, occurring in 38% of Aboriginal, 27% of Black and 9% of White women.²⁰
- Of the infants known to have contracted HIV through perinatal transmission in British Columbia between 1994 and 1999, 50% were Aboriginal.²¹
- A 3-year study (2000-2003) was conducted in British Columbia by the Chief's Health Committee of the First Nations Summit in partnership with Health Canada and the Canadian Blood Services, during which blood samples were taken from 5,242 pregnant Aboriginal women. A total of 15 tested positive for HIV for a prevalence rate of approximately 30 per 10,000.²² This is about three times higher than the rate of 9 per 10,000 seen in a study of the general population of women in BC who had prenatal testing during 2003.²³
- The MAK Project done in Vancouver in 2004 found that 32.4% of Aboriginal women (36/111) were HIV positive at baseline compared with 18.4% of non-Aboriginal women, and the baseline HIV infection was associated with early age of sex work initiation (<18 years).²⁴
- The CEDAR Project done between 2003 and 2005 among Aboriginal participants (14-30 years of age) in two urban centres of British Columbia found a higher proportion of HIV infection among women (13.1%) than men (4.3%) and a significant relation between HIV positive status at baseline and a history of sexual abuse.²⁵

Impact of HIV on Aboriginal women and heightened risk of mother-to-child transmission

Pregnant women infected with HIV are at risk of transmitting the virus to their unborn child. Data from some sites in western Canada have shown that a high proportion of HIV-infected pregnant women who deliver are Aboriginal. At all pediatric centres across Canada where children and HIV-infected mothers were followed between 1995 and 1997, 19% of the women seen (49/259) were Aboriginal women.¹⁶ Of 32 HIV-infected women who delivered in northern Alberta or the Northwest Territories in 1996-98, 29 (91%) were Aboriginal.¹⁷

Young Aboriginals are at greater risk of HIV infection

- A study of risk factors among 232 young people (below 25 years) who inject drugs in Vancouver found that 9 of 16 incident HIV cases (56%) were Aboriginal.¹¹
- The At-Risk Youth Study, conducted between 2005 and 2006 among drug-using and street-involved youth (14-26 years of age) in Vancouver Downtown East, found that 46.7% of the participants who were HIV positive at baseline were Aboriginal and were more likely to report injection drug use and to be co-infected with HCV; over half of HIV-positive Aboriginal participants also reported a history of sexual abuse.²⁶
- The CEDAR Project (2003-2005) among Aboriginal participants aged 14-30 years in two urban centres of British Columbia found at enrolment that 400 participants (74%) reported having had an HIV test during their lifetime, of whom 183 (46%) were tested regularly. Overall, 8% (46/543) tested HIV positive.²⁷
- A mixed methods study (2004-2005) among Aboriginal youth aged 15-30 years across Canada found that 50.8% of the survey participants (210/413) and 89.3% of the interview participants (25/28) had previously been tested for HIV. The most common reasons for not getting tested were the self-perceptions of being at low risk of HIV and not having sex with an infected person.²⁸

Conclusion

The available evidence suggests that the HIV epidemic in the Aboriginal community shows no sign of abating. Injecting drug use is currently the most common mode of HIV transmission among Aboriginal people, Aboriginal women make up a large part of the HIV epidemic in their community, and Aboriginal people appear to be infected at a younger age than non-Aboriginals. This indicates the different characteristics of the HIV epidemic among Aboriginal people and emphasizes the complexity of Canada's HIV epidemic. Better data on HIV/AIDS epidemiology and HIV testing among Aboriginal people and culturally appropriate community-based programs are needed to guide prevention and control strategies. In addition, it is vital to conduct further research to increase our understanding of the specific impact HIV has on Aboriginal people.

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Mission

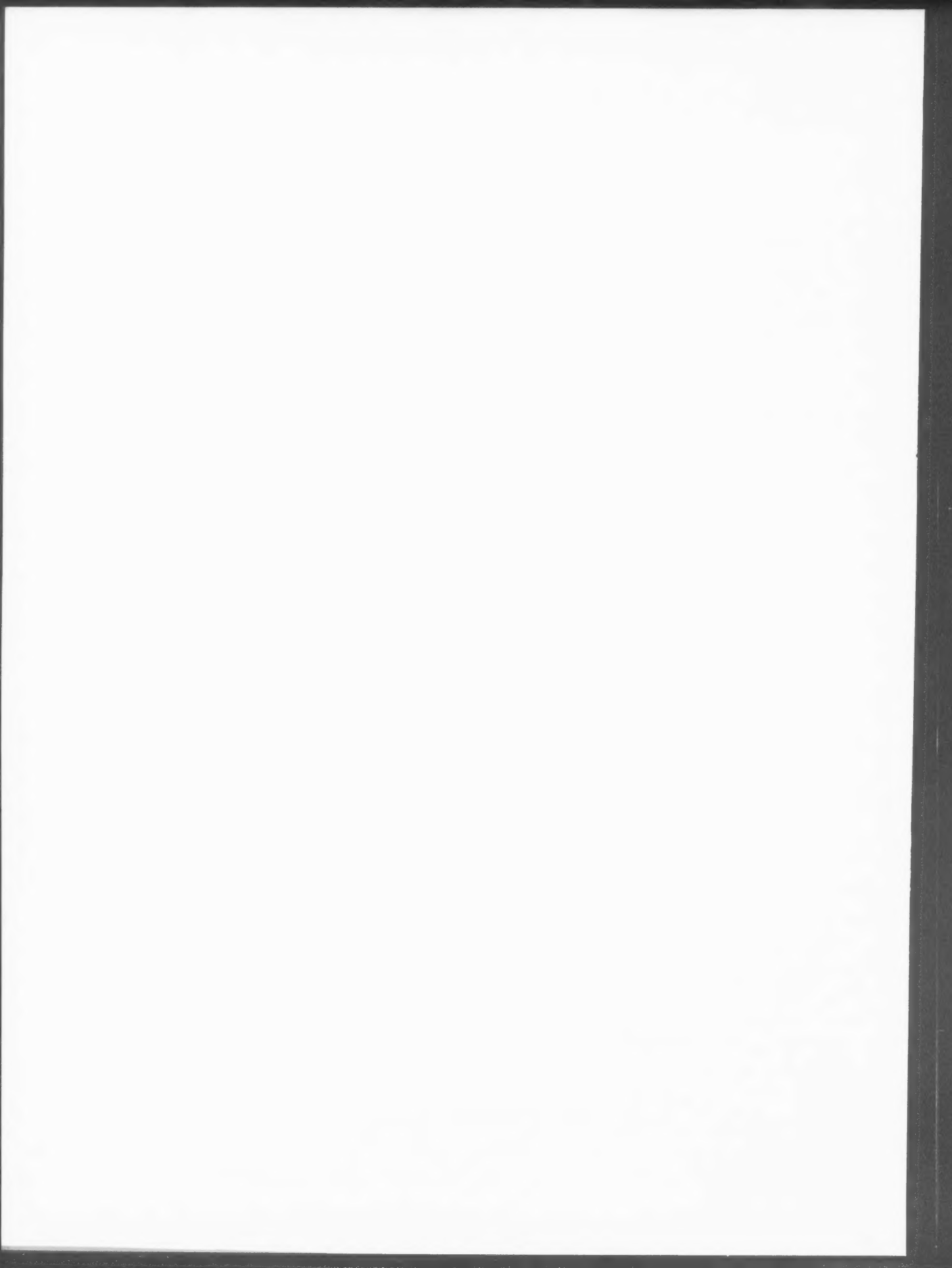
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Public Health Agency of Canada

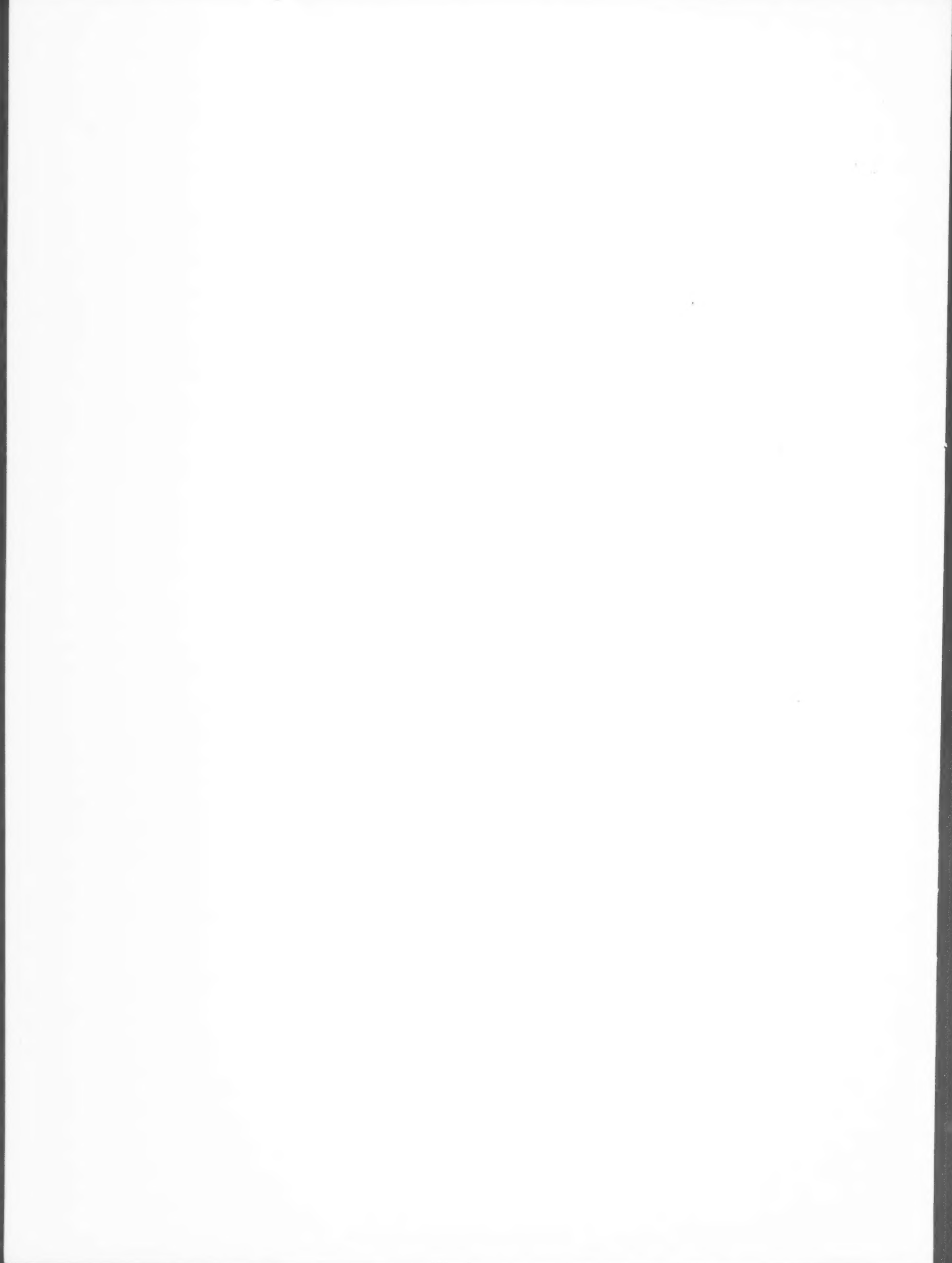
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HIV/AIDS Among Gay, Bisexual and Other Men Who Have Sex with Men in Canada

At a Glance

- In 2008, the MSM (men who have sex with men) exposure category continued to account for the largest proportion of positive HIV test reports among adults, representing 45.1% (557) of positive tests reported.
- The estimated number of new HIV infections attributed to the MSM exposure category also accounted for the highest proportion of new infections in 2008, representing 44% of estimated new infections.
- In 2008, an estimated 19% of men in the MSM exposure category were unaware of their HIV infection. This is lower than the overall estimated percentage (26%) of people living with HIV in Canada who were unaware of their HIV positive status. Still, this translates to an estimated 6,000 (4,500-7,500) people living with HIV in the MSM exposure category who were unaware of their HIV positive status.
- HIV transmission among MSM in Canada is ongoing; recent research indicates that certain sub-groups of MSM continue to be at considerable risk of HIV infection by engaging in risky sexual practices, such as unprotected anal intercourse with serodiscordant partners or partners of unknown HIV status.

Introduction

In Canada, the HIV/AIDS epidemic continues to have a disproportionate effect on gay, bisexual and other men who have sex with men (MSM). Despite past achievements in curbing the epidemic among MSM, research in the early 21st century pointed to an increase in the transmission of HIV among MSM in Western countries, including Canada. This evidence renewed questions about how to enhance existing programs and policies aimed at preventing the transmission of HIV among MSM.^{1,2}

This chapter draws together findings from multiple sources to provide an update on the status of HIV/AIDS among MSM in Canada. Specifically, it summarizes selected data from the most recently available routine HIV and AIDS surveillance data, selected findings from Phase 1 of M-Track (the national, second-generation HIV surveillance system focused on MSM in Canada) and data from the most recently available national estimates of HIV in Canada. Selected findings from recent research are also presented, including information on the prevalence and incidence of HIV among MSM in Canada and associated factors, as well as findings from research focusing on risk behaviours and correlates of risk behaviour among MSM in Canada. The chapter concludes with a discussion of the strengths and limitations of existing research and provides a summary of the findings presented.

Routine Surveillance

The Public Health Agency of Canada's Centre for Communicable Diseases and Infection Control (CCDIC) collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, death data are also collected. Health care providers and/or laboratories forward this information to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS diagnoses to the Centre, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, underreporting, missing information and undiagnosed infections. (Please refer to Chapter 3 for a full description of HIV/AIDS surveillance in Canada).

AIDS surveillance data³

- Starting in 1979 and up to December 31, 2008, there had been 21,300 AIDS cases reported to the Public Health Agency of Canada (PHAC). Since reporting began, the MSM exposure category has accounted for the largest proportion of total AIDS cases among adults (≥ 15 years), with a total of 13,419 cases or 68.3% of all AIDS cases reported with known exposure category. The MSM/IDU* exposure category has accounted for an additional 4.4% (869 cases) of the total number of AIDS cases reported among adults.
- With the exception of 2005, the number of AIDS diagnoses reported to PHAC has steadily declined over the last 10 years.
- In 2008, 255 AIDS cases were reported to PHAC. Of those for which exposure category was known, 45.5% (55 cases) were attributed to the MSM exposure category. This represented the largest proportion of AIDS diagnoses among adults in 2008.

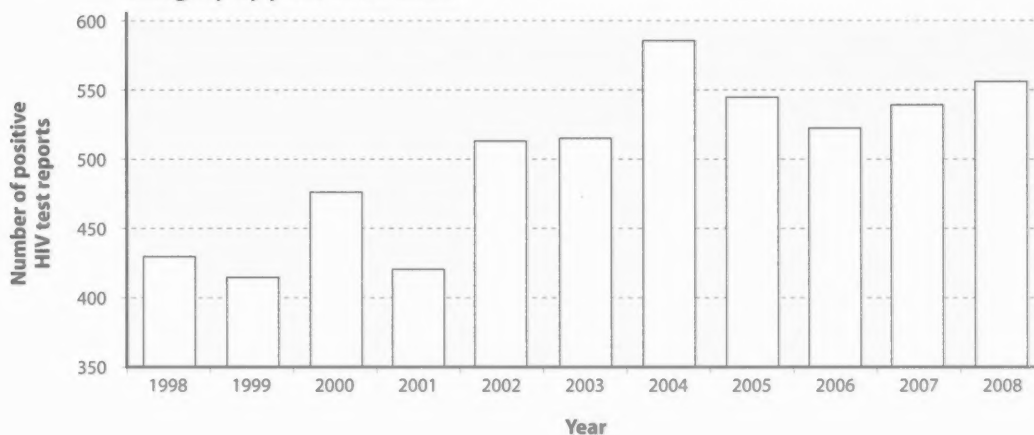
HIV surveillance data³

- As of December 31, 2008, a total of 67,442 positive HIV tests had been reported to PHAC since reporting began in 1985. Since reporting began, the MSM exposure category has accounted for the largest pro-

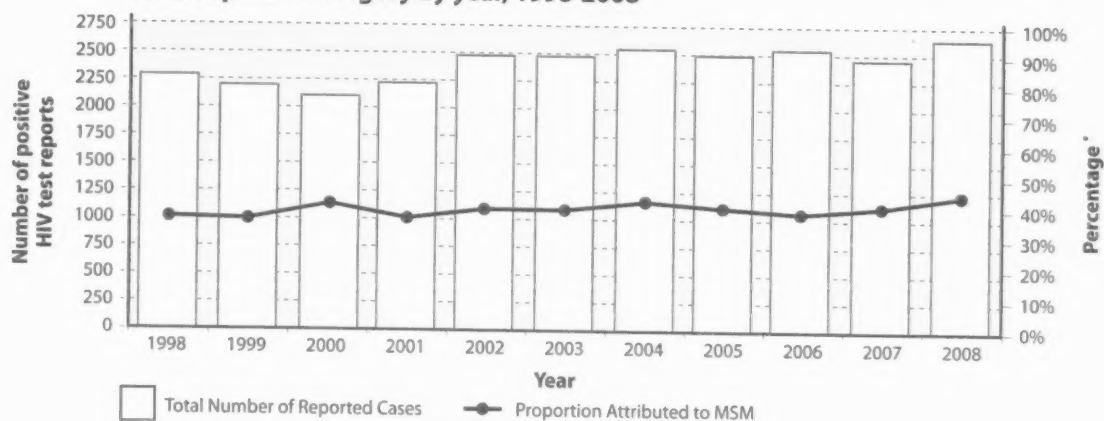
portion of positive HIV test reports among adults, with a cumulative 18,699 positive HIV test reports, representing 56.1% of total HIV positive test reports with known exposure category. The MSM/IDU exposure category has accounted for an additional 2.4% (790 test reports) of all positive HIV test reports.

- The number of positive HIV test reports among adults attributed to the MSM exposure category increased by 34.2% between 1999 (415 test reports) and 2008 (557 test reports), peaking in 2004, after which it declined for two consecutive years. In 2007 and 2008, the annual number of reported HIV positive tests increased slightly (Figure 1).
- In 2008, the number of positive HIV test reports attributed to the MSM exposure category continued to account for the largest proportion of HIV test reports, representing 45.1% (557 test reports) of all positive tests reported among adults (Figure 2). The MSM/IDU exposure category accounted for an additional 1.6% (20 test reports) of all positive HIV test reports in 2008.
- Over the period 2004 to 2008, the proportion of new positive HIV test reports attributed to the MSM exposure category has been relatively stable (Figure 2).

Figure 1. Number of positive HIV test reports among adults attributed to the MSM exposure category by year, 1998-2008



* MSM/IDU: men who have sex with men/people who inject drugs combined exposure category. For details on exposure categories, please refer to Chapter 3.

Figure 2. Total number of positive HIV test reports and proportion attributed to the MSM exposure category by year, 1998-2008

* Percentage based on total number minus reports for which exposure category was not reported and for which there was no identified risk.

Enhanced Surveillance/Population-Specific Surveillance Data

As part of the *Federal Initiative to Address HIV/AIDS in Canada*, PHAC monitors trends in HIV prevalence and associated risk behaviors in key vulnerable populations identified in Canada. The overall objectives of these second-generation HIV surveillance systems (known as the "Track" systems) are to describe the changing patterns in the prevalence and incidence of HIV infections, risk behaviour practices and testing patterns for HIV, hepatitis C and other sexually transmitted and blood borne infections (STBBIs) in each respective population. For a more detailed description of the Track systems, please refer to Chapter 3.

M-Track: second generation HIV surveillance among gay, bisexual and other men who have sex with men in Canada

M-Track is the national, second-generation HIV surveillance system among MSM in Canada. As of December 31, 2009, a total of six sites had participated in M-Track across Canada. M-Track was first implemented in Montreal in 2005. Between 2006 and 2007,

four additional sites joined M-Track: Toronto, Ottawa, Winnipeg and Victoria. Over 4,500 men participated in M-Track between 2005 and 2007 (Phase 1). In 2008, Vancouver became the most recent site to implement M-Track (see Table 1).

Summary of descriptive data[†] from M-Track Phase 1⁴

Participant overview and socio-demographic characteristics of participants

- 4,838 men across five sentinel sites participated in Phase 1 of M-Track (2005-2007) (Table 1).
- The highest proportion of respondents was between the ages of 30 and 49 (54%) with fewer respondents between the ages of 15 and 29 (26%) and over the age of 50 (20%).
- A substantial proportion of respondents self-reported their sexual orientation as gay (82%) and an additional 14% as bisexual. Others identified themselves as straight or "Other" (4%).
- When asked about their ethnic and/or cultural ancestry, the majority of men most strongly identified themselves as being North American (66%); 6% of respondents reported Aboriginal ancestry.

[†] Unless otherwise noted, the data presented here include eligible respondents (for any given variable) who provided responses. Respondents who did not provide responses (i.e. "Missing") or who responded "Don't know" or who "Refused" to answer were excluded from the analyses. Respondents who provided a dried blood specimen only (i.e. did not respond to the questionnaire) are excluded from all analyses presented here unless otherwise stated. No tests of statistical significance were conducted.

Table 1. Summary of M-Track sites, year of implementation and number of participants

Province	Site	2005	2006	2007	2008
British Columbia	Victoria			Phase 1 - 224 men	
British Columbia	Vancouver				Phase 2 - 1,169 men
Manitoba	Winnipeg		Phase 1 - 121 men		
Ontario	Toronto			Phase 1 - 2,020 men	
Ontario	Ottawa			Phase 1 - 516 men	
Quebec	Montreal	Phase 1 - 1,957 men			Phase 2 - 1,873 men
All sites			4,838 men surveyed		3,042 men surveyed to date

Sexual risk behaviours

- The majority of men reported multiple male sex partners (oral and/or anal sex) in the 6 months preceding survey administration (64%).
- Among men who reported having anal sex with a casual male partner* in the previous 6 months, nearly half reported consistent ("always") condom use during anal sex (insertive and/or receptive) (46%).
- With respect to lifetime history of commercial sex involvement,** roughly 10% of men independently reported giving or receiving money, drugs or other goods/services in exchange for sex.
- Men who participated in M-Track commonly reported looking for sex in a variety of social and other public settings in the 6 months preceding survey administration. For example, nearly a quarter of men reported looking for sex in social settings, such as community organizations/events, gay associations and other recreational groups (24%) as well as in public settings, such as parks and public restrooms (22%).

- A large proportion of men also reported looking for sex in bars (56%), in saunas (41%) and on the Internet (39%) in the previous 6 months.

- Among men who looked for sex in saunas and on the Internet, 36% and 57% reported doing so on a regular basis respectively (more than once a month).

HIV prevalence, testing and treatment history

- Most men who participated in M-Track reported having been tested for HIV (86%). Similarly, of men who reported that their most recent HIV test was negative a large proportion had been tested for HIV in the 2 years preceding survey participation (81%).
- Among participants who provided a biological sample of sufficient quantity for testing and who completed a questionnaire, the prevalence of HIV was 15%.† Of the men whose biological sample tested positive for HIV, 19% were unaware of their HIV positive status.‡

Sexually transmitted and other blood borne infections (STBBIs)

- With respect to other STBBIs, 63% and 67% of men reported ever having been tested for syphilis and HCV respectively.

*A casual partner is a man with whom the respondent had sex only once (a "one night stand" or an encounter in a bathhouse, for example). Casual partners do not include men to whom the respondent gave or from whom he received money, drugs or other goods or services in exchange for sex.

**Commercial sex involvement: giving or receiving sex in exchange for money, drugs or other goods or services.

† HIV screening was performed using the Bio-Rad GS rLAV HIV-1 EIA (enzyme immunoassay). Confirmatory testing was subsequently performed using the Bio-Rad Genetic Systems™ HIV-1 Western Blot assay. A positive result indicates a current HIV infection. Both the HIV screening (EIA) and confirmatory assay (Western Blot) are approved by Health Canada as diagnostic assays for use with dried blood spot (DBS) specimens.

‡ Excludes respondents who did not provide answers to questions regarding HIV testing history.

- Among participants who provided a biological sample of sufficient quantity for testing and who completed a questionnaire, the lifetime prevalence of syphilis and HCV was 6% and 5% respectively.⁸
- M-Track participants were also asked to report whether they had ever been diagnosed with an ST-BBI; 42% of men reported having being told by a doctor that they had an STBBI.⁹

In addition to determining the prevalence and identifying patterns of HIV, HCV and syphilis testing, and describing changing patterns and trends in sexual behaviour among MSM in Canada, one of M-Track's primary objectives is to establish a core set of comparable behavioural measures across participating sentinel surveillance sites while addressing local and regional issues and questions of specific local interest. As such, respective sentinel sites produce and publish site-specific findings in the form of summary reports, research papers, conference posters and abstracts. Site-specific publications often explore questions and issues of particular interest to community members, researchers, and policy and program analysts.

Selected site-specific findings from M-Track sentinel sites are presented along with other independent research findings below (please see "Summary of recent data on HIV prevalence, incidence and risk behaviours among MSM").

National Estimates of HIV/AIDS Prevalence and Incidence

PHAC uses multiple methods to provide an overall picture of the HIV epidemic among all Canadians living with HIV (including AIDS), including those with both diagnosed and undiagnosed infection. Using these combined methods, PHAC produces two types of estimates: prevalence, the number of people living with HIV (including AIDS), and incidence, the number of new infections in a 1-year period. PHAC produces estimates of national HIV prevalence and incidence approximately every 3 years. (Please refer to Chapter 1 for a full description of national HIV prevalence and incidence estimates for 2008).

National estimates for 2008: HIV/AIDS prevalence data⁵

- National estimates for 2008 indicate that the number of people living with HIV (including AIDS) in Canada (prevalence) continues to rise. Between 2005 and 2008, the prevalence of HIV (including AIDS) is estimated to have increased by 14%, from 57,000 in 2005 to 65,000 in 2008.
- The most recent national estimates indicate that MSM continued to be the most affected group, representing the highest proportion of cases at an estimated 48% (31,330) of all prevalent cases in 2008. However, this estimated overall proportion has not changed since 2005.
- The combined MSM/IDU exposure category was estimated to represent an additional 3% (2,030) of prevalent cases.
- Of the estimated 65,000 people living with HIV in Canada in 2008, 26% (16,900) were unaware of their HIV infection. This represents a slight decrease from 2005, when it was estimated that 27% of people living with HIV in Canada were unaware of their HIV infection.
- A lower percentage of HIV-positive individuals in the MSM exposure category were estimated to be unaware of their HIV infection relative to all people living with HIV in Canada (19% in the MSM exposure category vs. 26% of all prevalent infections). This translated to an estimated 6,000 (4,500-7,500) people living with HIV in the MSM exposure category who were unaware of their HIV-positive status.
- By comparison, a higher proportion of HIV-infected people in the injection drug use exposure category and in the heterosexual exposure category (endemic and non-endemic combined) were estimated to be unaware of their HIV infection (25% and 35% respectively).

National estimates for 2008: HIV/AIDS incidence data⁵

- The estimated number of new cases of HIV (incident) in 2008 is thought to have remained the same or to have increased slightly since 2005, with an estimated range of 2,300 to 4,300 new cases in 2008 compared with an estimated range of 2,200 to 4,200 new cases in 2005.

⁸ HCV testing was performed using the Ortho[®] HCV version 3.0 EIA. Confirmatory testing is not performed for samples that test positive. A positive result indicates past or present HCV infection and does not discriminate acute from chronic or resolved infections. Validation of commercially available laboratory tests on DBS specimens for HCV is ongoing.

Syphilis testing was performed using the Serodia[®] TP-PA assay. Confirmatory testing is not performed for samples that test positive. A positive result indicates past or present syphilis infection. Validation of commercially available laboratory tests on DBS specimens for syphilis is ongoing.

⁹ For the purpose of these analyses, STBBI included gonorrhoea, chlamydia, genital or anal warts, syphilis, genital herpes, hepatitis A and B or unknown hepatitis virus.

- MSM continued to account for the highest proportion of estimated new cases in 2008, representing 44% of estimated new cases. This was slightly lower than the estimated 45% of new cases attributed to the MSM exposure category in 2005 but represented the same overall number of new cases (1,000-1,900) as in 2005.
- The combined MSM/IDU exposure category represented an additional 3% (50-130 cases) of new HIV cases in 2008.

Summary of Recent Data on HIV Prevalence, Incidence and Risk Behaviours among MSM

In addition to the data gathered through routine and enhanced HIV surveillance, as well as the national HIV estimates, several studies exploring HIV and associated risk factors among MSM in Canada are ongoing.

Below is a summary of available data and literature results for the period 2006 to 2009 in MSM populations in Canada.

Prevalence of HIV among MSM in Canada

Earlier on in the HIV/AIDS epidemic, study findings suggested that the prevalence of HIV among MSM in Canada was very high.⁶⁻⁹ More recent findings, however, suggest that it may have declined and/or that there is significant variation across different subpopulations (Annex 1).^{1, 10-19} As described in some detail in Annex 1, the prevalence of HIV among MSM in more recent analyses ranges from a low of 1.0% in a subsample of young non-White MSM born outside of Canada and living in Vancouver or Montreal¹⁸ to a high of 24% in a small sample of Black MSM in Toronto ($n = 168$).¹³

Recently described correlates of HIV prevalence include unprotected receptive anal sex, lower levels of education, not being in the labour force and regular attendance at bathhouses, as well as hepatitis B infection, urethral gonorrhoea and genital or anal warts.¹¹ An independent analysis that explored the relationship between circumcision and HIV status did not find any correlation between the two variables.²⁰

Incidence of HIV among MSM in Canada

Fewer recent publications have provided estimates of the incidence of HIV among MSM (Annex 1).²¹⁻²³ Despite differences in methodology, studies continue to document a relatively high incidence of HIV among MSM, ranging from a low of 0.62/100 person-years (py) in a cohort of MSM in Montreal²¹ to a high of 1.14/100 py based on data from the Laboratory Enhancement Study in Ontario.²²

Similar to the conclusions drawn from the national estimates of HIV incidence among MSM in Canada,⁵ recent studies suggest that the incidence of HIV among MSM in Canada is relatively stable or is increasing slightly.²²

In addition to documenting the incidence of HIV among MSM, several researchers have explored factors associated with HIV seroconversion among MSM. Recently reported risk factors for HIV seroconversion include any anal-sex-related practices with a serodiscordant, casual or commercial sex partner,²¹ as well as high numbers of casual partners, sharing a needle with someone who is HIV positive²¹ and experiencing stressful life events.²⁴

For example:

- Burchell et al. analyzed data from the Polaris HIV Seroconversion Study to investigate how stress may be related to HIV infection and found that the odds of becoming HIV infected were 3.14 times higher among men who reported more than five stressful events during the period of infection compared with men who reported no stressful events. After controlling for receptive anal intercourse, the relation between stress and HIV infection remained but was not as strong (adjusted odds ratio: 2.16, 95% confidence interval 1.07, 4.38).²⁴
- In the Omega Cohort Study, based on over 7 years of follow-up, the following factors were independently associated with HIV seroconversion: a high number of casual partners (50+), sharing a needle with someone who was HIV positive and all anal-sex-related practices with a high-risk partner, including regular partners of positive or unknown HIV status, casual partners and commercial sex partners.²¹

Risk behaviours and correlates of risk behaviour among MSM in Canada

Recent data on sexual practices and HIV-related risk behaviour indicate that certain subgroups of MSM continue to be at considerable risk of HIV infection by engaging in risky sexual practices, such as unprotected anal intercourse (UAI) with serodiscordant partners or partners of unknown HIV status.^{13, 21, 25, 26} Recent studies also indicate that casual sex is common among MSM; these studies point out that the majority of men surveyed continue to practise safe sex.^{13, 21, 26} Differences across studies, including definitions of safe sex, however, make it difficult to make direct comparisons across findings and thus generally preclude one from drawing any specific conclusions regarding trends in risk behaviours over time.

For example:

- Analyses of Montreal M-Track/ARGUS data indicated that, in the 6 months preceding survey participation, 33% of men reported having had six or more casual partners and 21% reported at least one episode of UAI with a casual partner. These analyses also found that 28% of men who reported that they were HIV negative or of unknown HIV status had had UAI with a man whom they thought was HIV positive or whose HIV status was unknown.²⁷
- In an analysis of Omega Cohort Study data, one-third of participants reported more than five casual partners, and nearly 40% of men reported any UAI in the previous 6 months; however, any UAI was more commonly reported among men having sex with HIV-negative partners.²¹
- In an independent analysis of the Omega Cohort Study data, George et al. reported a statistically significant and consistent temporal increase in UAI; increases in UAI were reported with regular seroconcordant partners, with casual partners and with any type of partner. However, the authors note that this increase was not consistent across all groups of men as defined by partnership and serostatus.²⁵
- In contrast, comparisons across two cross-sectional Sex Now surveys found no significant change in HIV risk taking with respect to sexual practices across survey periods (2002 and 2004), most notably in the indicator considered most critical (UAI with a partner of unknown HIV status). Data from Sex Now further suggest that HIV-related risk behaviours were largely confined to a quarter of survey participants. The survey also found that casual sex was common among participants (64%); of these men, a majority reported consistently safe practices (61%), and 39% reported some HIV-related risk behaviour(s). Moreover, just over half of the men (52%) who reported anal sex with a casual partner had used a condom consistently.²⁶

Numerous and conceptually diverse correlates of HIV risk behaviours, such as UAI, having multiple partners and commercial sex involvement, have been explored among MSM. Studies have primarily focused on factors associated with UAI in general, such as recreational drug use.^{17, 19, 28-32}

Although findings across studies have varied, recent publications continue to support the notion that a host of complex and interrelated factors are associated with HIV-related risk behaviours among MSM. The reasons underlying these behaviours, however, are equally numerous and complex.

For example:

- Using data from the Ontario Men's Survey, Xu and colleagues found that the odds of reporting UAI with both regular and casual partners were higher among men who always and sometimes (vs. never) disclosed their HIV status; who moved to larger communities; who reported being HIV positive (vs. those of unknown serostatus); who reported more than 10 partners; who engaged in commercial sex; and finally among men who used recreational drugs.³³
- Haubrich et al. provided a brief summary of HIV-related sexual risk events identified by Polaris Study participants. Participants indicated that substance use, notably the use of crystal methamphetamine, ecstasy, cocaine and alcohol, had an impact on their sexual risk behaviours, most often UAI. Other factors reported included entering into a new relationship and validation of a monogamous relationship.³¹
- In an analysis of Vanguard Study participants, Lampinen and colleagues reported that the use of nitrite inhalants was significantly associated with having casual partners, with reporting multiple casual partners (including partners of unknown serostatus and HIV-positive partners) and with anal intercourse. A detailed analysis of the data did not, however, find any association between nitrite inhalant use and unprotected sex with casual partners.¹⁹
- Montreal M-Track/ARGUS investigators also explored correlates of UAI and reported that, among self-reported HIV-negative men and men of unknown HIV status who had had sex with a non-couple partner at their last sexual encounter (LSE), being in a couple with a man was one of the strongest background factor correlates of UAI. Other background correlates of UAI in the final multivariate model included agreeing with the statement that an HIV-positive man taking medication is less likely to transmit HIV, and reporting a history of STI diagnosis. Notably, the number of male sex partners in the previous 6 months was not associated with UAI at LSE. Event-level factors associated with UAI in the final model included finding the partner to be very or extremely attractive and using alcohol (five or more drinks) or cocaine within 2 hours of or during sex.²⁹
- The Ontario M-Track/Lambda study team has also recently explored the prevalence of, and factors associated with, UAI. In a subanalysis of men who reported UAI with a casual partner in the previous 6 months, 35.7% ($n = 163$) and 63.2% ($n = 294$) reported UAI with casual partners believed to be HIV-positive or of unknown HIV status respectively.

Among HIV-negative men, the use of non-injection drugs was associated with UAI with casual partners believed to be HIV positive.²⁸

Others have explored the role that the Internet may be playing in the lives of MSM with respect to risk behaviour.¹⁷

For example:

- Chiasson et al. recruited men on-line to assess whether men who met partners on-line were more likely to have UAI than those who did not. No differences were found between the two groups in bivariate or multivariate analysis. This event-based analysis also reported that 23% of men had had sex with multiple partners at their LSE, a high-risk behaviour that is not well described in the literature and requires further study, given the higher potential of HIV transmission. Among men who reported multiple partners at their LSE, UAI was significantly associated with being HIV positive and with use of crystal methamphetamine, sildenafil and alcohol before sex, regardless of whether partners were met on- or off-line. Among men reporting a single partner at LSE, use of crystal methamphetamine and having no college degree were significantly associated with UAI.¹⁷
- Chiasson et al. further hypothesized that men meeting partners on-line may be more inclined to disclose their HIV status to potential partners before meeting in person, and their findings confirmed this hypothesis. At their LSE, men who met their partners on-line were significantly more likely to disclose their HIV status than those who met their partners off-line.¹⁷
- Ogilvie and colleagues used data from the Sex Now survey to explore the differences in sexual risk behaviour between MSM who seek partners on the Internet and those who do not. They reported higher risk behaviours among MSM seeking sex on the Internet: for example, having significantly more sexual partners and seeking sexual partners in other higher-risk environments known to be associated with the transmission of HIV. However, no differences were reported with respect to UAI between the two groups.³⁴

The social influences of risk taking among MSM are equally multifaceted.³²

For example:

- Trussler et al. reported that, compared with men who reported only safe sex in the previous year, the odds of reporting UAI with a casual partner of unknown serostatus were higher among men who reported feeling pressured to have unsafe sex; who had broken a safe sex agreement with their primary partner; who were inconsistent in their views about sexual safety; who had numerous partners; and, finally, among men who reported use of crystal methamphetamine during sex.³²

- Calzavara et al. used longitudinal logistic regression to explore the effect of stress specifically as it relates to UAI with non-regular partners. The relation between stressful life events and sexual risk behaviours was found to be complex. An increase in UAI was positively associated with financial stress, losing one's job, ending a romantic relationship, and drug and alcohol related problems. The "death of a close friend" was inversely related to UAI, as was serious illness among HIV-positive participants.³⁵

Specific sexual practices, such as delayed condom application (DCA), barebacking, group sex and fisting have also garnered the attention of recent research.^{1,30,36}

For example:

- In a subsample of data from the Ontario Men's Survey, the overall prevalence of DCA in the previous 12 months among 2,614 men during insertive anal intercourse was 47.0%. Factors significantly and positively associated with DCA included bathhouse attendance, lifetime history of STIs, multiple partners (> 5 male partners), disclosure of HIV status to casual partners and experience with condom failure. The use of cocaine, poppers and steroids, receipt of money and/or other items in exchange for sex with a male, and multiple sexual relationships with a regular male partner (past 3 months) were all associated with DCA and unsafe sexual activities.¹⁰
- As a site-specific add-on to the Ontario M-Track/Lambda survey, participants were asked questions about DCA. Among sexually active men, on the basis of practices in the previous 6 months nearly half of participants (46.8%, $n = 677$) reported DCA-R (receptive); 32.0% ($n = 460$) and 15.1% ($n = 217$) reported multiple occasions and a single episode of DCA-R respectively. In multivariate modeling, no socio-demographic characteristics were found to be associated with DCA-R. However, the authors noted that men reporting DCA-R also reported other unsafe sexual behaviours.³⁷
- The Montreal M-Track/ARGUS study team reported that 9% of men had purposely sought UAI (barebacking) with a casual partner.²⁷
- Adam et al. sought to delineate the characteristics of men who report that they like to, and look to, participate in barebacking. They found that, compared with men who reported casual sex partners but no interest in barebacking, men who identified themselves with barebacking environments had a distinctive profile of unprotected sexual practices (more likely to report both unprotected receptive and insertive anal intercourse). In this study sample, men who liked to, and looked to, participate in barebacking accounted for just over half (51.9%) of

all men surveyed who reported UAI. Further, these men formed a distinct "circuit" with beliefs and attitudes highly divergent from those of other MSM around them regarding appropriate norms and expectations of sexual practice.¹

- To better understand situations in which unprotected sex is the norm, Adam et al. recruited men most likely to be involved in bareback scenes. On the basis of data collected through semi-structured interviews with a small number of men ($n = 34$), the study authors reported different beliefs among distinct circuits of MSM and "taken-for-granted rules of conduct for sexual interactions" (p. 759) which that give rise to high-risk situations. For example, many of the HIV-positive men interviewed spoke of "being part of a social environment where 'everybody knows' a set of rules whereby sex without condoms can happen as default circumstance to be interrupted only when a partner asserts a need to protect himself" (p. 759).³⁶
- Finally, given the limited information available on fisting, as a site-specific add-on, the Vancouver M-Track/ManCount survey asked participants whether they had been fisted by a partner in the previous 6 months. The reported prevalence of fisting in this sample of MSM in Vancouver was 4.5% ($n = 33$) and after adjustment for potential confounders was found to be associated with looking for sex in public venues, pre-coital hygiene and the use of sex toys.³⁸

Patterns of risk behaviours across different types of partnerships have also recently been addressed in the literature:

In their brief synopsis of findings from a subsample of partnered men who took part in the Men, Sex and Love Web study, the authors reported that HIV discordant couples were significantly more likely to consistently use a condom during anal sex. By contrast, being in a partnership of unknown concordance was not associated with consistent condom use.³⁹

The characteristics of, and HIV-related risk behaviours in, specific subpopulations of MSM, such as MSM who also inject drugs (MSM/IDU), MSM who were born outside of Canada and MSM who are living with HIV, have also been the subject of recent analyses.

For example:

- Among MSM who also inject drugs, HIV-related risk behaviours, such as borrowing used needles, are reportedly higher than among other IDU who do not report sex with men.⁴⁰
- George and colleagues combined data from two prospective Canadian cohorts (Omega and Van-

guard) to explore whether sexual behaviours and other factors that may increase vulnerability to HIV differ between MSM born outside of Canada and Canadian-born MSM. One of the key findings from their analyses was that White MSM born outside of Canada were more likely to report high-risk sexual behaviours, including being most likely to have sex with a known HIV-positive partner and most likely to have unprotected sex while travelling outside of their home province. Non-White respondents born outside of Canada, on the other hand, were more likely to have ever sold sex.¹⁸

- Preliminary analysis of data from a cohort study in Montreal of people living with HIV (MAYA study) reported that of sexually active MSM 77% of participants ($n = 240$) reported consistent condom use in the previous 6 months with partners of negative or unknown HIV status. The authors conclude that other findings from this analysis suggest that cognitive factors, such as perceived behavioural control and a longer period of time since diagnosis (> 3 years), are associated with safe sex practices among HIV-positive MSM.⁴¹ Using GEE (generalized estimating equations) modeling the authors also reported additional data based on this cohort: among MSM living with HIV, being younger, not being an IDU, shorter time period since HIV diagnosis (< 3 years) and receiving money for sex were factors associated with UAI with HIV-negative partners or partners of unknown HIV status.⁴²
- Again using a subsample of data from the MAYA study, Lavoie and colleagues focused on HIV-positive MSM and their level of risk-taking with different types of partners and also explored how viral load level may alter behaviours. They found that approximately 20% of MSM had had unprotected anal sex with a regular negative partner. The authors reported that HIV-positive MSM in this sample may have adjusted their level of risk-taking according to the serostatus of their partner. In this analysis, viral load levels were not associated with risk-taking behaviours.⁴³

In addition to studying correlates and causes of HIV-related risk behaviours among MSM, other topics of relevance have also recently been studied, including HIV testing patterns and factors associated with HIV testing among MSM. HIV testing uptake is relatively high among MSM in Canada, including subpopulations of MSM, and men who report higher-risk behaviours also report higher odds of testing.^{4, 44, 45} Non-consensual condom removal during anal sex and non-disclosure of HIV-positive status by a partner have been reported as reasons for seeking HIV testing among MSM.³¹

Comment

Strengths and limitations

Many of the research studies presented in this chapter have a number of important strengths. For example, most of the findings presented here are based on recent data drawn from large community samples of MSM, enabling researchers to explore a wide variety of hypotheses. Many of these studies have generated new evidence, critical to prevention programs and policy making at all levels: national, provincial and local. Moreover, because of the relatively large survey sample sizes, adequate statistical power is available to examine multiple risk behaviours and their associated factors.

There are also several limitations that should be considered when interpreting the results presented here. The majority of the findings are based on cross-sectional studies, thus, any inferences regarding cause and effect between the variables being explored must be made with caution. Generally, studies in this area must rely on self-reported data, which may introduce a variety of social biases. For example, it is possible that some information, such as sexual behaviours and recreational drug use, were misreported or underreported by some respondents because of the sensitive nature of the questions. To overcome some of the inherent challenges in this type of research, most studies used venue-based or other forms of convenience sampling. Given this, the findings cannot be generalized beyond the study populations.

For more specific study-level limitations, please refer to the respective studies referenced within this chapter.

Finally, as previously noted, an important limitation of the present update on the epidemiology of HIV/AIDS among MSM in Canada is that differences across studies, including variations in recruitment methods, eligibility criteria, variable definitions, as well as differences in statistical methods and power, make it challenging to make direct comparisons across findings. This makes it difficult to draw any specific conclusions regarding trends in risk behaviours over time.

Conclusion

When available data from the literature, HIV surveillance systems and the national HIV estimates are considered as a whole, it is clear that the transmission of HIV among MSM in Canada is ongoing.

Recent research indicates that certain subgroups of MSM continue to be at considerable risk of HIV infection by engaging in risky sexual practices, such as UAI with serodiscordant partners or partners of unknown HIV status. Research further suggests that men who engage in one high-risk behaviour tend to engage in

other, higher-risk, behaviours, forming clusters of men at higher risk of HIV transmission. For example, men who partake in or seek sex in one higher-risk behaviour or in higher-risk environments, such as in bathhouses, also tend to partake in or seek sex in other higher-risk environments, such as public settings and on Internet sites.^{1, 28, 34, 37, 40, 46, 47}

UAI, particularly receptive UAI, with a partner of unknown or HIV-positive status or with a casual or commercial sex partner continues to be reported as the main risk factor for HIV seroconversion among MSM.^{10, 21, 28, 48}

Several hypotheses have been explored in an effort to explain why some men continue to practise unsafe sex. Although specific outcome measures and findings across studies have varied, recent publications continue to support the notion that a host of complex and interrelated factors are associated with HIV-related risk behaviours among MSM.^{17, 19, 28-34} A limited number of recent studies have also started exploring and identifying the psychological and social factors underlying decisions to engage in riskier sexual behaviours.^{31-33, 35}

Despite the continuing risk behaviours reported in many studies, a growing body of research indicates that most men continue to have safe sex most of the time.^{26, 41, 49} Nonetheless, as outlined above, those who report UAI with both regular and casual partners represent a significant subpopulation.³³

While the scientific community continues to be interested in gaining a better understanding of the context in which high-risk behaviours take place, research suggests that some MSM are using strategies, such as "serosorting", to mitigate their risk of acquiring HIV.^{21, 43, 50, 51} The effectiveness of said strategies, however, is still controversial.^{21, 51}

Myths and misconceptions regarding the transmission of HIV still exist among some groups of MSM.⁵² Thus, as Adam and colleagues have recently suggested, prevention messages are still valuable, "as there are always new men entering into relations with other men, whether they arrive from the upcoming generation, immigration, or self-discovery" (p. 420).¹ These authors note, however, that simply having the facts at hand is not necessarily enough to bring about behaviour change and thus a consistent reduction in the transmission of HIV in all MSM.¹ Rather, the implication for prevention programs is to recognize that there is an uneven distribution of risk among MSM and that prevention messages relevant to one group of men may lack resonance with others.¹ Researchers have further argued that sexual health services should offer services in multiple languages and offer multicultural services through various mediums to meet the needs of diverse MSM.^{52, 53}

Some have specifically suggested that the Internet is an important delivery tool for information about safer sex and the transmission and prevention of HIV and sexually transmitted infections among MSM.⁵⁴

Taken together, the findings presented here suggest that investigation of specific risk behaviours, measured more consistently over time in diverse groups of MSM across Canada, is still needed. Improved information could, in turn, be used to enhance policies, programs and services intended to reach and benefit MSM in Canada.

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Annex 1: Prevalence and Incidence of MSM in Canada

Authors and year of publication	Study design & study objectives	Recruitment & study period	Study population & sample size	Subsample used for analysis	HIV incidence	HIV prevalence
Allman et al. (2009) ¹	• Cross-sectional • Self-administered questionnaire • Ontario Men's Survey (OMS) "To examine the prevalence of [delayed condom application] within a gay community and explore factors associated with condom use among those who practice only safer sex and those who report at least some unprotected anal sex." (775)	Venue-based purposive sampling February–June 2002	Gay and bisexual men 15 years and older in Ontario <i>n</i> = 5,080	Men who answered questions about delayed condom application in the previous 12 months <i>n</i> = 2,614	NA	Based on self report 8.9%
Myers et al. (2009) ²	• Cross-sectional • Self-administered questionnaire and optional saliva sample • Ontario Men's Survey (OMS) "To describe hepatitis C (HCV) and HIV prevalence and co-infection, and to examine variables associated with infection in a community sample of men who have sex with men (MSM)." (1)	Venue-based purposive sampling February–June 2002	Gay and bisexual men, 15 years and older in Ontario <i>n</i> = 5,080	Men who provided sufficient fluid to conduct laboratory tests to detect the presence of both HCV and HIV antibodies <i>n</i> = 3,304	NA	Based on saliva specimen Overall: 9.0%
Xu et al. (2009) ³	• Cross-sectional • Self-administered questionnaire • Ontario Men's Survey (OMS) and Lambda (M-Track sentinel site) "To compare the prevalence of HIV, HCV, HIV-HCV co-infection between bisexual and gay men in two cross-sectional studies undertaken at different points in time." (66B)	Venue-based sampling <u>OMS:</u> February–June 2002 <u>Lambda:</u> March–July 2007	Overall sample size not specified <u>OMS:</u> Bisexual, <i>n</i> = 355 Gay, <i>n</i> = 2,480 <u>Lambda:</u> Bisexual, <i>n</i> = 217 Gay, <i>n</i> = 1,876	Men who provided biological specimens of sufficient quantity for laboratory testing	NA	<u>OMS</u> (Based on saliva sample) 7.3% among bisexual men; 1.3% among gay men <u>Lambda</u> (Based on dried blood spot [DBS]): 14.7% among bisexual men; 20.7% among gay men

Annex 1: Prevalence and Incidence of MSM in Canada

Authors and year of publication	Study design & study objectives	Recruitment & study period	Study population & sample size	Subsample used for analysis	HIV incidence	HIV prevalence
Adam et al. (2008) ⁴	- Cross sectional survey - Toronto Pride Survey 2005 "To delineate characteristics of men who report that they like to participate in the "bareback scene" and cruise "bareback Web sites" by comparing them with men who had casual male partners during the last 6 months but do <i>not</i> report an interest in bareback scenes or Web sites." (421)	Men who attended Toronto Pride Event 2005 June 2005	Men who had sex with a man during the previous 6 months or reported a gay identity <i>n</i> = 922	NA	NA	Based on self-reported serostatus 12.6%
George et al. (2008) ⁵	Self-administered questionnaire "To improve our understanding of BMSM communities and networks in Toronto for evidence-informed HIV prevention efforts/ programs." (80A)	Venue-based sampling June 2007–January 2008	Black MSM in Toronto <i>n</i> = 168	NA	NA	Based on self-report 24%
Hirshfield et al. (2008) ⁶	- Cross-sectional - Internet survey "To assess the utility of screening for, and characteristics associated with, depressive symptoms in an online survey of MSM." (904)	Banner linking to survey advertised on gay-oriented American and Canadian websites October 2003–March 2004	MSM 18 yrs & older from 10 Canadian provinces, the United States and 65 other countries <i>n</i> = 4,030	Men who met the study criteria and did not refuse or omit a response: <i>n</i> = 2,964 Prevalence is based on those who had been tested: <i>n</i> = 2,414	NA	Based on self-reported HIV status Overall: 9.0%
Lampinen et al. (2008) ⁷	- Prospective open cohort study - Self-administered questionnaire - Blood sample - Vanguard Project "To determine incidence of, prevalence of, and risk factors for sexual orientation-related physical assault in young men who have sex with men (MSM)." (1028)	Venue-based convenience sampling May 1995–May 2004	Young (15 to 30 years of age), gay, bisexual and other MSM living in the greater Vancouver area who had not previously received an HIV-seropositive test result <i>n</i> = 863	Men with ≥1 follow-up study visit and complete data for the variables of greatest interest in present analysis <i>n</i> = 521	NA	Based on blood sample 7.1% among men with history of assault prior to study enrolment; 2.3% among men with no history of assault prior to study enrolment.

Annex 1: Prevalence and Incidence of MSM in Canada

Authors and year of publication	Study design & study objectives	Recruitment & study period	Study population & sample size	Subsample used for analysis	HIV incidence	HIV prevalence
Lavoie et al. (2008) ⁸	- Cohort study - Self-administered questionnaires - Structured interviews - HIV, syphilis and hepatitis B testing - Omega "To estimate human immunodeficiency virus (HIV) incidence risk factors among men who have sex with men (MSM)." (25)	Venue- and other convenience-based sampling October 1996–July 2003	MSM 16 yrs & older, HIV negative at baseline living in Montreal or surrounding area $n = 1,846$	Participants with at least one follow-up visit $n = 1,587$	0.62/100 person years (PY) (95% confidence interval 0.41–0.84)	NA
Remis et al. (2008) ⁹	- Cross sectional study - Lambda (M-track sentinel site) "To examine the association of HIV prevalence and participant characteristics." (26A)	Venue-based sampling March–July 2007	MSM: Toronto: $n = 2,021$ Ottawa: $n = 517$	MSM who provided DBS sample	NA	Based on DBS sample Toronto: 23.2% Ottawa: 11.9%
Chiasson et al. (2007) ¹⁰	Cross-sectional on-line survey "To assess whether men who have sex with men (MSM) are more likely to report unprotected anal intercourse (UAI) with partners met online compared with those met offline" (235)	Banner linking to survey advertised on gay-oriented American and Canadian websites October 2003–March 2004	MSM 18 yrs & older from 10 Canadian provinces, the United States and 65 other countries $n = 4,030$	18 years of age or older from the United States or 10 Canadian provinces and reported sex with a new or casual male partner in their last sexual encounter in the previous 3 months: $n = 1,683$ Prevalence is based on those who reported ever having an HIV test: $n = 1,298$	N/A	Based on self-report 11%

Annex 1: Prevalence and Incidence of MSM in Canada

Authors and year of publication	Study design & study objectives	Recruitment & study period	Study population & sample size	Subsample used for analysis	HIV incidence	HIV prevalence
George et al. (2007) ¹¹	- Prospective cohort study - Omega Cohort and Vanguard Project "To identify key differences in sexual, psychological and other characteristics between foreign-born and Canadian born MSM that may increase their vulnerability for HIV." (10)	<u>Vanguard</u>: Venue-based sampling May 1995–May 2004 <u>Omega</u>: Venue- and other convenience-based sampling October 1996–July 2003	<u>Vanguard</u>: Young (15 to 30 years of age) HIV-seronegative gay, bisexual and other MSM living in the greater Vancouver area: <i>n</i> = 863 <u>Omega Cohort</u>: MSM 16 yrs & older, HIV seronegative at baseline living in Montreal or surrounding area: <i>n</i> = 1,846	Combined sample from both studies used for analysis: <i>n</i> = 1,148. Analysis restricted to baseline data as of Sept 1999 for subjects <30 years of age Canadian Aboriginals excluded from analysis	NA	Based on biological samples 1.5% – White born in Canada 2.1% – White born outside of Canada 2.8% – Non-white born in Canada 1.0% – Non-white born outside of Canada
Lampinen et al. (2007) ¹²	- Prospective cohort - Self-administered questionnaire - Serologic testing - Vanguard Project "To study the prevalence and correlates of contemporary nitrite inhalant use among young MSM in Vancouver." (2)	Venue-based sampling May 1995–May 2004	Young (15 to 30 years of age) HIV-seronegative gay and bisexual men living in the greater Vancouver area <i>n</i> = 863	Restricted to eighth and final wave of data collection, Oct 2002 to May 2004 <i>n</i> = 354	NA	Based on biological sample Overall: 7%
Remis et al. (2007) ¹³	- Cross-sectional survey - Objective was not stated	Questionnaire was sent with all first-time HIV-positive test results and 1:200 sample of HIV-negative results January 2001–September 2006	All those who received first-time HIV-positive test results and 1:200 sample of HIV-negative results in Ontario from January 2001 to September 2006	People reporting MSM as a risk factor <i>n</i> = 2,745	Laboratory based (detuned assay) Crude: 1.75/100 PY Adjusted: 1.14/100 PY	NA

Annex 1: Prevalence and Incidence of MSM in Canada

Authors and year of publication	Study design & study objectives	Recruitment & study period	Study population & sample size	Subsample used for analysis	HIV incidence	HIV prevalence
Burchell et al. (2006) ¹⁴	Secondary data analysis of databases records "To describe incidence among men who have sex with men (MSM) undergoing repeat testing in Ontario in 1993-2003 and to determine whether rates have declined since 1999." (44A)	MSM in Ontario identified by computerized and manual record linkage 1993-2003	$n = 603$ seroconverters; 17,361 repeat-negative testers Combined: 60,469 PY	Men who reported sex with men but no injection drug use	0.97/100 py	NA

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HIV/AIDS Among People Who Inject Drugs in Canada

At a Glance

- Injection drug use exposure accounted for 17.7% of cumulative adult HIV case reports and 8.6% of cumulative adult AIDS cases up to December 31, 2008.
- Over the last decade, a decreasing trend in the proportion of positive HIV tests attributed to injection drug use among men has been noted; however, an increasing trend among women has been observed since 2003.
- The 2008 national HIV estimates indicate that the proportion of new HIV infections attributed to injecting drug use (17%) was slightly higher than the estimate in 2005 (16%).
- High levels of risky injection and sexual behaviours were reported in surveillance data and other cross-sectional and cohort studies, which suggest that the potential for transmission of HIV among people who inject drugs (IDU) continues to be significant.
- Research suggests that among IDU, Aboriginal people are disproportionately affected by HIV.
- High levels of injecting and sexual risk behaviours among younger IDU (less than 30 years) are reported across targeted studies, illustrating that this at-risk IDU population is particularly vulnerable to HIV.

Introduction

In the early 1980s, the Canadian HIV epidemic was concentrated among men who have sex with men (MSM). By the early to mid-1990s, there was a change toward increasing transmission among people who inject drugs (IDU), and by 1996 approximately 35.0% of the total number of estimated new HIV infections that occurred in Canada that year were attributed to the use of injection drugs.¹ The Centre for Communicable Diseases and Infection Control (CCDIC) of the Public Health Agency of Canada (PHAC) has recently published national HIV prevalence and incidence estimates for 2008. The 2008 estimates indicate that the proportion of new infections attributed to injection drug use increased slightly to 17.0% in 2008, compared with 16.0% in 2005.² Routine HIV surveillance data show that, in 2008, 19.1% of adult positive HIV tests reported to CCDIC were attributed to injection drug use, down from a peak of 34.0% in 1996.³ This chapter provides an update on the status of HIV/AIDS among IDU in Canada.

Findings from multiple sources are drawn together to provide an update on the status of HIV/AIDS among IDU in Canada. Specifically, the chapter summarizes selected data from the most recently available routine HIV and AIDS surveillance data, data from the most recently available national estimates of HIV in Canada, and selected findings from Phase 2 of I-Track (the national, second-generation HIV surveillance system focused on IDU in Canada). Selected findings from recent research are also presented, including information on the prevalence and incidence of HIV among IDU in Canada and associated factors, as well as findings from research on risk behaviours and correlates of risk behaviour among IDU in Canada. The chapter concludes with a discussion of the strengths and limitations of existing research and provides a summary of the findings presented.

Routine Surveillance

CCDIC collects surveillance data on positive HIV test reports and reported AIDS cases in Canada. Epidemiologic information that is collected includes (but is not limited to) age, sex, risks associated with the transmission of HIV and self-reported ethnicity. For AIDS cases, data on death are also collected.

This information is forwarded to provincial and territorial public health officials, who, in turn, voluntarily submit positive HIV test reports and AIDS cases to CCDIC, where the data are synthesized and analyzed at the national level. There are several limitations regarding surveillance data, including reporting delays, underreporting, missing information and undiagnosed infections. (Please refer to Chapter 3 for a full description of HIV/AIDS surveillance in Canada.)

AIDS surveillance data³

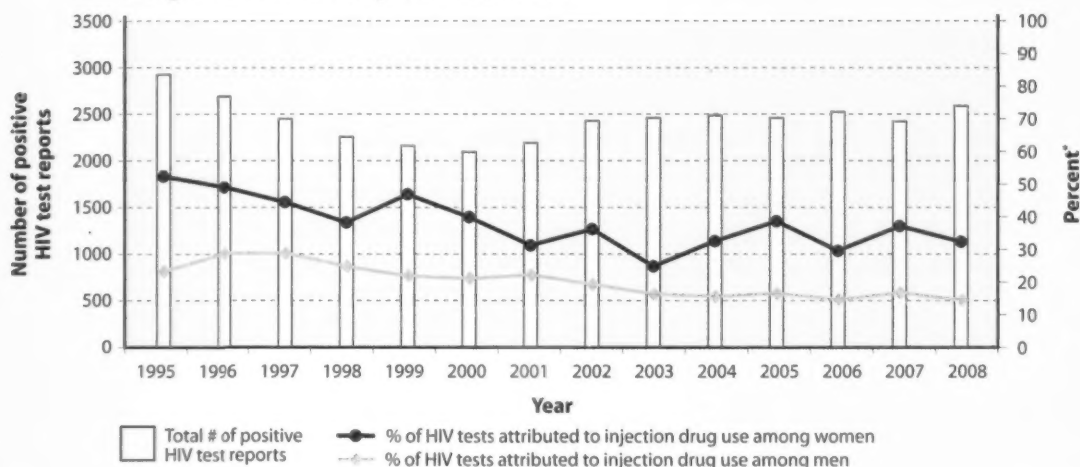
- The cumulative number of adult (≥ 15 years) AIDS cases reported to CCDIC from 1979 to December 31, 2008, was 21,052. Of those with known exposure category, 8.6% ($n = 1,687$) were attributed to injection drug use.
- Overall, among both men and women there was a general rise in the proportion of AIDS cases attributed to injection drug use since reporting began in 1979, until 1998 when the proportion reached 22%. Since 1998 there has been a gradual decline, with slight variations over the years, including a spike to 32.7% in 2006 followed by a decrease in 2008.
- Of the total cumulative adult AIDS cases attributed to injection drug use for which exposure category and sex were reported, 72.5% were male and 27.5% female.

- Of adult AIDS cases attributed to injection drug use, the proportion of males increased steadily from 67.4% in 1998, peaking in 2001 at 82.5% and subsequently decreasing to 39.1% in 2008.

HIV surveillance data³

- Since HIV reporting began in 1985 up to December 31, 2008, a cumulative total of 63,287 positive HIV tests among adults were reported in Canada, of which 17.7% were attributed to injection drug use. An additional 2.4% were attributed to the MSM-IDU exposure category. MSM-IDU refers to a combined exposure category that includes men who have sex with men and men who inject drugs. For details on exposure categories, please refer to Chapter 3.
- Of positive HIV tests reported between January 1, 2008, and December 31, 2008, for which age and exposure category were available, those of individuals aged 30 to 39 years (33.5%) and 40 to 49 years (32.3%) accounted for the highest proportion attributed to injection drug use.
- Over the last decade, a decreasing trend in the proportion of positive HIV tests attributed to injection drug use among men has been noted; however, an increasing trend among women has been observed since 2003 (Figure 1).

Figure 1. Total number of positive HIV test reports and proportion attributed to injection drug use in Canada, by sex, 1995-2008



* Percentage based on total number minus reports for which exposure category was not reported and for which there was no identified risk.

Enhanced Population-Specific Surveillance Data

As part of the *Federal Initiative to Address HIV/AIDS in Canada*, PHAC monitors trends in HIV prevalence and associated risk behaviours in key vulnerable populations

identified in Canada through second-generation HIV surveillance systems.

The overall objectives of these systems (known as the "Track" systems) are to describe the changing patterns in the prevalence and incidence of HIV infections, risk behaviours and testing patterns for HIV, hepatitis C virus (HCV) and other sexually transmitted and blood borne infections (STBBIs) in each respective population. For a more detailed description of the Track systems, please refer to Chapter 3.

I-Track: second-generation HIV surveillance among IDU in Canada

I-Track is the national, second-generation surveillance system focused on people who inject drugs. The pilot phase of I-Track was undertaken between October 2002 and August 2003 at five sites (urban and semi-urban) across Canada (Victoria, Regina, Sudbury, Toronto and the SurvUDI network, including Ottawa/Outaouais, Montreal, Québec City, Montérégie, Mau-

rice/Centre du Québec, Saguenay/Lac St-Jean, Estrie (Eastern Townships) and Abitibi/Témiscamingue).⁴ The pilot phase demonstrated the feasibility of the sentinel surveillance system and also laid the foundation for undertaking I-Track Phase 1.

Phase 1 was completed in seven sites (Victoria, Edmonton, Regina, Winnipeg, Sudbury, Toronto and the SurvUDI network) between October 2003 and May 2005.⁵ Phase 2 was completed in 10 sites between 2005 and 2008 (Victoria, Central and North Vancouver Island sites, Prince George, Edmonton, Regina, Thunder Bay, Sudbury, Toronto, Kingston and the SurvUDI network). The implementation of Phase 3 began in April 2010.

Selected descriptive results from I-Track Phase 2 (2005-2008)^{abcd}

A total of 3,287 IDU participated in I-Track Phase 2 from 2005 to 2008 across 10 sites (Table 1).

Table 1. Summary of I-Track Phase 2 sites and HIV prevalence by site, 2005-2008^b

	Number of participants (total = 3,287)	Year of survey	Laboratory-confirmed HIV prevalence % (no. tested)	Laboratory-confirmed HCV life-time prevalence % (no. tested)
Victoria	250	2005	12 (240)	74 (240)
Central and North Vancouver Island ^c	221	2008	6 (208)	72 (208)
Prince George	157	2008	18 (151)	77 (151)
Edmonton	248	2008	13 (247)	69 (247)
Regina	251	2007	9 (249)	69 (249)
Thunder Bay	150	2007	5 (111)	51 (111)
Sudbury	148	2005	14 (140)	67 (141)
Toronto	362	2006	5 (355)	65 (352)
Kingston	224	2006	3 (202)	73 (202)
SurvUDI Network ^d	1,276	2006	21 (1271)	69 (1271)

^a Includes Campbell River, Nanaimo, Port Alberni, Courtenay, Duncan and Port Hardy.

^b Includes Ottawa/Outaouais, Montreal, Québec City, Montérégie, Maurice/Centre du Québec, Saguenay/Lac St-Jean, Estrie (Eastern Townships) and Abitibi/Témiscamingue.

Demographic characteristics of I-Track Phase 2 participants

- The majority of participants (68%) were male.
- The average and median age was 38 years.

- Of the total sample, 25% self-identified as Aboriginal (First Nation, Métis or Inuit).
- Over half of the sample (54%) reported having less than high school education, 22% had earned their high school diploma, and 24% had any post-secondary education.

^a Unpublished data from I-Track: *I-Track: Enhanced Surveillance of Risk Behaviours among People who Inject Drugs. Phase 2 (2005-2008)*. Ottawa: Surveillance and Risk Assessment Division, Centre for Communicable Diseases and Infection Control, Public Health Agency of Canada, 2010. I-Track Phase 2 report anticipated for release at a later date.

^b Respondents who did not provide a response (i.e. "missing") or who responded "Don't know" or "Refused" were excluded from the analyses, unless otherwise noted. No tests of statistical significance were conducted.

^c HIV screening was performed using the Bio-Rad GS rLAV HIV-1 EIA (enzyme immunoassay). Confirmatory testing was subsequently performed using the Bio-Rad Genetic Systems™ HIV-1 Western Blot assay. A positive result indicates a current HIV infection. Both the HIV screening (EIA) and confirmatory assay (Western Blot) are approved by Health Canada as diagnostic assays for use with dried blood spot (DBS) specimens.

HIV prevalence^c

- Among participants who provided a biological sample of sufficient quantity for testing, the prevalence of HIV ranged from 3% to 21% across the 10 I-Track Phase 2 sites (Table 1).
- The HIV prevalence was 14% among males, 12% among females and 1% among transgender participants.
- Within age groups, the HIV prevalence was 6% among participants under 30 years, 16% among those 30 to 49 years and 15% among those 50 years and older. The prevalence of HIV was 14% among participants of Aboriginal origin and those of other ethnicities.

Life-time HCV prevalence^d

Based on the nature of testing done for HCV, the results relate to "life-time prevalence", that is, indication that the individual had been infected with the hepatitis C virus at some point in his/her lifetime (past or present).

- Among participants who provided a biological sample of sufficient quantity for testing, the life-time prevalence of HCV ranged from 51% to 77% across the 10 I-Track Phase 2 sites (Table 1).
- The life-time HCV prevalence was 69% among both males and females and 91% among transgender participants.
- Within age groups, 50% participants under 30 years had antibodies indicative of past or present HCV infection. The figures were 73% among those 30 to 49 years and 85% among those 50 years and older. The life-time prevalence of HCV was 69% among participants of Aboriginal origin and those of other ethnicities.

Risk behaviours: selected results from I-Track Phase 2

Injecting practices

- Overall, the drugs most commonly injected in the previous 6 months were cocaine (52%), morphine (non-prescribed) (13%), heroin (7%) and dilauid (7%).
- Just over 20% of participants reported borrowing or lending used needles or syringes in the previous 6 months.
- Of those who borrowed or lent used needles or syringes, approximately 60% were male, approximately 60% were between 30 and 49 years of age, and about 20% were of Aboriginal origin.

- Of those who borrowed used needles or syringes, the people from whom they borrowed most often were regular sex partners (43%) and close friends (35%).
- Among self-reported HIV-positive participants, of those respondents who reported lending used needles or syringes, 60% were male and 40% were female.
- Approximately 40% of participants reported borrowing or lending used injection equipment, such as cookers, water, filters, tourniquets, swabs and/or acidifiers, in the previous 6 months.
- Of these, just over 60% were male; approximately 60% were between 30 and 49 years of age; and almost 30% were of Aboriginal origin.
- Overall, participants reported most often borrowing used injection equipment from their close friends (45%) and from their regular sex partners (35%).

Sexual practices

- 18% of all participants reported having two or more male sex partners in the previous 6 months; approximately 80% of these participants were female, about 60% were between 30 and 49 years of age, and approximately 30% were of Aboriginal origin.
- 25% of all participants reported having two or more female sex partners in the previous 6 months; over 90% of these participants were male, over 60% were between 30 and 49 years of age, and approximately 20% were of Aboriginal origin.
- In the previous 6 months, 4% of participants reported selling sex in exchange for drugs, money or other material goods and 6% of participants reported buying sex in exchange for drugs, money or other material goods.
- Of those who reported vaginal sex with a casual partner, approximately 50% reported inconsistent condom use (i.e. did not always wear a condom); over 80% of them were male, nearly 60% were between 30 and 49 years of age, and just over 20% were of Aboriginal origin.

HIV testing practices

- Over 90% of all participants had ever been tested for HIV: 91% of males, 93% of females and 92% of transgendered participants.
- Overall, 85% of those who had ever been tested for HIV and who reported being HIV negative had been tested in the previous 2 years.
- Of those who reported that they were HIV negative and had been tested in the previous 2 years, 66% were male and 33% were female.

^d HCV testing was performed using the Ortho® HCV version 3.0 EIA. Confirmatory testing is not performed for samples that test positive. A positive result indicates past or present HCV infection and does not discriminate acute from chronic or resolved infections. Validation of commercially available laboratory tests on DBS specimens for HCV is ongoing.

- Overall, the most common reasons for never having been tested for HIV were as follows: "I am at a low risk for infection" (21%), "I never thought about it" (21%) and "I do not want to know" (18%).
- Of participants with laboratory-confirmed HIV based on the I-Track survey specimen who were unaware of their HIV positive status^e, that is, they reported never having been tested for HIV, or that they were HIV negative at the last test, 67% were male, 74% were between 30 and 49 years of age and 34% were of Aboriginal origin.

Highlights of special analyses from I-Track Phase 1 (2003-2005)

- In a special analyses of population subgroups captured by the M-Track (surveillance for MSM, Phase 1, 2005-2007) and I-Track (Phase 1, 2003-2005) systems, HIV prevalence was similar among MSM-IDU (M-Track - 26.4%) and IDU-MSM (I-Track - 25.7%).⁶
 - This comparison suggested differences in terms of injecting behaviour, for example, use of methamphetamine (30.4% among M-Track participants vs. 4.7% among I-Track participants), cocaine (63.7% vs. 91.7%) and heroin (18.6% vs. 34.4%).
 - Significant differences in sexual behaviours differences were also found: sex with women (30.3% among M-Track participants vs. 57.3% among I-Track participants), sex with multiple male partners (75.2% vs. 60.4%), sex with casual partner(s) (81.0% vs. 47.9%), consistent condom use with casual partners (anal sex: 18.3% vs. 62.0%), and paying for sex with a male sex partner (30.7% vs. 6.3%).
 - These analyses highlighted the complex relationship between sexual orientation and injecting and sexual risk behaviours, which are not necessarily captured by surveillance definitions for at-risk populations and support the notion that a wider range of prevention messages and services should be provided to all at-risk populations, regardless of the population label that is ascribed to them.
 - An analysis of crystal methamphetamine (CM) use amongst I-Track Phase 1 participants revealed higher levels of risk behaviour for CM users compared to those who injected other drugs.⁷ CM users were younger, lived in unstable housing, injected most often in public places, injected with used equipment and were of Aboriginal origin. Female CM users were more likely to have engaged in commercial sex and were more like to be HIV positive.
 - HIV risk profiles were explored between male IDU reporting male sexual partners (IDU-MSM) and those reporting only female sexual partners (MFSP) in a sample of male IDU from I-Track (Phase 1, 2003-2005).⁸
 - HIV prevalence was higher among male IDU who had sex with men (25.7%) than among male IDU who only had female sex partners (11.9%).
 - With respect to injecting behaviours, a higher proportion of IDU-MSM reported injecting cocaine most often (76.7% vs. 53.4%); in public (39.6% vs. 27.2%); with needles previously used by someone else (33.2% vs. 15.4%); and with such used needles, from people they did not know (27.1% vs. 11.0%).
 - Compared to MFSP, higher proportions of IDU-MSM reported the following sexual risk behaviours: casual sex partners (66.7% vs. 50.0%), client sex partners (42.7% vs. 2.0%) and inconsistent condom use with casual sex partners during vaginal (57.4 vs. 44.9%) and oral sex (82.3% vs. 70.9%).
 - Analyses of I-Track Phase 1 (2003-2005) surveillance data found that IDU who had ever used a needle exchange program (NEP) were more likely to have had recent HIV testing than those who had never used NEP services.⁹
 - Female IDU, IDU under 30 years of age, and IDU who had ever used an NEP were more likely to be recent testers (IDU tested within the preceding year) compared to IDU tested more than one year previously or never tested.
 - IDU who self-identified as Aboriginal were less likely to have had an HIV test in the previous year than participants of other ethnicities.
- In addition to determining the prevalence and identifying patterns of HIV and HCV testing and describing changing patterns and trends in sexual behaviour among IDU, one of I-Track's primary objectives is to establish a core set of comparable behavioural measures across participating sentinel surveillance sites while also addressing local and regional issues and questions of specific local interest. Respective sentinel sites produce and publish site-specific findings in the form of summary reports, research papers, conference posters and abstracts. Site-specific publications often explore questions and issues of particular interest to community members, researchers, and policy and program analysts. Selected site-specific findings from I-Track sentinel sites are presented along with other independent research findings below (please see "Summary of recent data on HIV prevalence, incidence and risk behaviours among IDU").

^e Excludes respondents who did not provide answers to questions regarding HIV testing history.

National Estimates of HIV/AIDS Prevalence and Incidence

PHAC uses multiple methods to provide an overall picture of the HIV epidemic among all Canadians living with HIV (including AIDS), including those with both diagnosed and undiagnosed infection. Using these combined methods, PHAC produces two types of estimates: prevalence, the number of people living with HIV (including AIDS), and incidence, the number of new infections in a 1-year period. PHAC produces estimates of national HIV prevalence and incidence approximately every 3 years. (Please refer to Chapter 1 for a full description of national HIV prevalence and incidence estimates for 2008).

National estimates for 2008: HIV/AIDS prevalence data²

- At the end of 2008, an estimated total of 65,000 (54,000-76,000) people in Canada were living with HIV infection (including AIDS), which represents an increase of about 14% from the 2005 estimate of 57,000 (47,000-67,000).
- IDU represented 17% (11,180) of all prevalent cases in 2008, which is slightly lower than the 2005 estimate (18%).
- The combined MSM-IDU exposure category was estimated to represent an additional 3% (2,030) of prevalent cases in 2008, which is unchanged from 2005.
- Approximately 25% of HIV-positive IDU were unaware of their infection. This percentage corresponds to an estimated 2,800 (2,000-3,600) people living with HIV in the IDU exposure category who were unaware of their HIV-positive status.

National estimates for 2008: HIV/AIDS incidence data²

- The number of new infections in 2008 (estimated range between 2,300 and 4,300) was about the same as or slightly greater than the estimated range in 2005 (2,200 to 4,200).
- The injection drug use exposure category continued to account for a high proportion of estimated new cases in 2008, representing 17% (390-750). This was slightly higher than the estimated 16% of new cases (360-680) attributed to injection drug use in 2005. This estimated increase was in part due to new HIV diagnoses among IDU in Saskatchewan.
- The combined MSM-IDU exposure category represented an additional 3% of estimated new HIV cases (50-130 cases) in 2008 which is unchanged as compared to 2005.

- Among Aboriginal persons, an estimated 66% of new HIV infections were attributed to injection drug use, which is higher than the estimation of 63% in 2005.
- Among women, a slightly higher proportion of estimated new infections were attributed to injection drug use in 2008 (29%) as compared to the estimated proportion in 2005 (27%).

Summary of Recent Data on HIV Prevalence, Incidence and Risk Behaviours among IDU

In addition to the national estimates and data collected through routine and enhanced HIV surveillance, many ongoing research studies are exploring HIV prevalence, incidence and risk behaviours among IDU in Canada. This section summarizes the results from HIV/AIDS research among IDU in Canada that were published in peer-reviewed journals from January 1, 2006, to January 31, 2010. Selected site-specific findings from I-Track sentinel sites are also presented here.

Prevalence of HIV and HCV infection among IDU in Canada

Recent measures of the prevalence of HIV and HCV infection in Canada are summarized below.

- The SurvUDI network has been conducting surveillance since 1995 in sentinel sites across the province of Quebec and in Ottawa, Ontario. HIV prevalence for the overall network increased from 11.5% in 1995 to a peak of 18.6% in 2003. Among IDU who participated in the SurvUDI network from 1995 to June 2008, the cumulative HIV prevalence was 14%.
 - From 2003 to June 2008, the prevalence of HCV was 63%, and the overall proportion of those co-infected with HIV and HCV was 13%.¹⁰
 - For the 2007 SurvUDI recruitment year, the overall HIV prevalence was 18%, and sentinel site HIV prevalence was 21.5% in Montreal, 17.0% in Quebec City, 3.0% in Ottawa and 9.9% in semi-urban sites.¹⁰
- In 2006, it was estimated that of the 505,000 people 15 years or older who were living in Vancouver, 6,108 were infected with HIV, providing an overall HIV prevalence of 1.21%. The IDU and MSM subgroups accounted for the greatest proportion of HIV infections.¹¹
- The Cedar Project, a community-based cohort, examined the prevalence of HIV and HCV and associated risk behaviours among Aboriginal youth

(14-30 years of age) who used drugs (injecting and non-injecting) and who were living in Vancouver and Prince George in 2003 to 2005. HIV prevalence was significantly higher among participants living in Vancouver (17%) than those living in Prince George (7%); however, HCV prevalence was found to be lower in Vancouver (57%) than in Prince George (62%).¹²

- o Among female participants of the Cedar Project, HIV prevalence was 13.1%, which was three times higher than the HIV prevalence among male participants (4.3%). HCV prevalence was also higher among females (43.6%) as compared with males (25.4%).¹³
- o The prevalence of HIV among sexually abused Aboriginal youth participating in the Cedar Project was significantly greater than among participants with no history of sexual abuse (13% vs. 4%).¹⁴
- Analyses of data (1996 to 2005) derived from two prospective cohort studies of IDU in Vancouver, the Vancouver Injection Drug Users Study and the Scientific Evaluation of Supervised Injecting cohort, found that Aboriginal IDU had a significantly elevated baseline prevalence of HIV infection as compared with those of other ethnicities (25.1% vs. 16.0%).¹⁵
- A cross-sectional survey examined the prevalence of HIV and HCV infection among inmates from seven Quebec provincial prisons ($n = 1,607$) in 2003. The HIV prevalence was 2.3% among male participants and 8.8% among female participants. The prevalence of HCV infection was 16.6% and 29.2% among male and female participants respectively. Among the male IDU inmates the HIV prevalence was 7.2%, and among male inmates who did not inject drugs it was 0.5%. For females the prevalence of HIV among IDU was 20.6% and among those who did not inject drugs was 0%. The prevalence of HCV infection was 53.3% among the male IDU inmates and 2.6% among the male inmates who did not inject drugs; the respective prevalence of HCV among women in these groups was 63.6% and 3.5%.¹⁶
- In a sample of 400 individuals who had used crack in the previous 6 months and were attending needle exchange distribution programs in Montreal in 2006-2007, HIV prevalence among current injectors (having recently injected), past injectors (not having recently injected) and never-injectors was found to be 22.4%, 8.5% and 6.0% respectively.¹⁷
- HIV and HCV prevalence and associated risk behaviours among IDU crack smokers (dual users) and crack smokers with no history of injection drug use were examined in a support group of the Vancouver

Area Network of Drug Users (VANDU) in 2004. Both HIV and HCV prevalence was high among crack smokers with no history of injection drug use (22% and 43% respectively). Among dual users, HIV prevalence was slightly higher (30%) and HCV prevalence was nearly twice as high (79%) as compared with crack smokers.¹⁸

Incidence of HIV among IDU in Canada

In Canada, only a few studies have estimated HIV incidence, and these results are summarized below.

- HIV incidence was 2.9 per 100 person-years (PY) across all sites of the SurvUDI network from 1995 to 2008. It ranged from 1.3 per 100 PY in semi-urban sites to 2.4 per 100 PY in Quebec City, 3.3 per 100 PY in Montreal and 3.5 per 100 PY in Ottawa. Overall HIV incidence significantly decreased across the SurvUDI network from 1995 to 2006 ($p < 0.001$).¹⁰
- From the analyses of data derived from two prospective cohort studies of IDU in Vancouver (1996 to 2005), the cumulative HIV incidence at 48 months' follow-up was higher among Aboriginal IDU (18.5%) than among IDU of other ethnicities (9.5%). In multivariate analyses, Aboriginal ethnicity was independently associated with elevated HIV incidence.¹⁵

Risk behaviours among IDU in Canada

Recent literature suggests that high levels of risky injection and sexual practices among IDU are not infrequent. Below is a summary of risk behaviour research findings.

Injecting practices

- Data derived from the prospective Vancouver Injection Drug User Study (VIDUS) cohort (1996 to 2005) were used to examine the role of increased crack use, associated factors and HIV seroconversion among IDU over two time periods (past and recent). Analyses revealed that daily cocaine injection was independently associated with HIV seroconversion across both periods, whereas daily crack smoking only emerged as an independent predictor of HIV infection more recently.¹⁹
- Of IDU who participated in the SurvUDI network from 2003 to 2008, 85.7% had injected cocaine, 55.9% had injected opiates (non-prescribed), and 34.9% had injected dilauidid in the previous 6 months.¹⁰
- Among IDU participating in a cross-sectional survey in Montreal in 2004-2005, factors such as large injecting networks, frequent mutual injections, younger age and male sex were stronger predictors of equipment borrowing and/or lending.²⁰

Sexual practices

- The prevalence and potential risk factors for inconsistent condom use (not always using a condom during insertive sex) were examined among Aboriginal youth participating in the Cedar Project (2003-2005). The prevalence was 52%. Inconsistent condom use was significantly associated with ever being forced to have sex, history of a sexually transmitted infection, having a regular sex partner who used injection drugs and having a casual sex partner who used injection drugs.²¹

Social determinants of health

The social determinants of health can be defined as the social conditions in which people live and work.²² These include the conditions associated with early childhood development; education, employment and work; food security, health services, housing, income and income distribution; social exclusion; the social safety net; and unemployment and job security.²³ The following highlights research that examined risk behaviours related to social determinants in IDU populations.

Injecting environment and housing

- The relation between exposure to street-based drug scenes and HIV risk factors was examined from data derived from the VIDUS cohort study (2006-2008). Unstable housing, daily crack use, outdoor assisted injecting and sex work involvement were significantly associated with drug scene exposure.²⁴
- Neighbourhood location was examined as a risk factor for HIV incidence among IDU who participated in the VIDUS cohort study from 1996 to 2004. Residence in Vancouver's downtown east side was an independent predictor of HIV seroconversion.²⁵
- The prevalence of public injecting and related factors were examined among IDU who participated in the VIDUS cohort study from 2003 to 2005. Of 620 participants, 22.9% reported "usually" or "always" injecting in public in the previous 6 months. Factors associated with recent frequent public injecting included homelessness, frequent crack use and frequent heroin injection.²⁶
- In a sample of IDU drawn from the St. Luc Cohort Study, the relations between injection behaviours and neighbourhood characteristics were examined. Inner city IDU living in socio-economically disadvantaged neighbourhoods were more likely to practise high-risk injection behaviours.²⁷

Needle exchange service access and use

- In a sample of IDU drawn from the St. Luc Cohort Study in 2004 to 2006, IDU who exclusively acquired syringes at an NEP or a pharmacy had a lower prevalence of high-risk injection behaviour than IDU with inconsistent syringe-access patterns.²⁸
- Results from a survey conducted in Winnipeg from 2003 to 2004 among IDU showed that syringe sharing among IDU depended on both the availability of clean syringes and social network relationships. The participant's relationship to a risk network member (sex partner, family member) and difficulty of access to syringes were associated with syringe sharing.²⁹

Food security

- The prevalence of food insecurity and associations with injecting risk behaviours were examined in a sample of IDU in London, Ontario. Food insecurity was frequent among IDU and was strongly correlated with sharing of needles and injection equipment (water, cooker, filter).³⁰

Social exclusion and quality of life

- The MAYA project, a longitudinal study on the quality of life of people living with HIV, described the psychosocial characteristics that differentiate male IDU from other subgroups: heterosexual non-IDU males, MSM non-IDU and women. Compared with the other three subgroups, male IDU had significantly lower scores on quality of life, anxiety and depression, and family and friends social integration scales. They had a less diversified social network and more frequently used alcohol and drugs as a coping strategy.³¹

Risk behaviours and their correlates among youth

Youth remain an at-risk population for injection drug use and HIV infection. A summary of recent research examining risk behaviours and their correlates among youth follows.

- The prevalence and correlates of injection drug use were examined among street-involved youth enrolled in the At-Risk Youth Study (ARYS) in Vancouver (2005-2006). Of the 478 participants, 42% reported having injected drugs, and the median age at first injection was 17.5 years. The drugs most commonly used during first injection were cocaine (27%) and CM (23%).³² A high level of borrowing or lending syringes (20.9%) was noted among those who injected drugs. The need for help to inject and frequent heroin use increased the risk of syringe sharing.³³

- In the same ARYS cohort, factors significantly associated with injection drug use included age greater than 22 years, HCV infection, history of sex work, history of incarceration, having dropped out of high school, downtown east side Vancouver residence, age greater than 15 years at first witnessing a drug injection³² and CM use.³⁴
- Participants recruited from the ARYS cohort were interviewed to explore the transition to injecting and first injection experiences. Young IDU aged 16 to 26 years were socialized into injecting by another drug user well known to them who facilitated the first injection episode.³⁵
- An analysis of data from the VIDUS cohort (1996-2006) examined differences between younger (less than 30 years) and older (30 years or older) IDU. Elevated levels of risk behaviours were noted among younger IDU, including a higher proportion of females, more frequent injection, history of sex work, history of incarceration, more frequent syringe borrowing and homelessness.³⁶
- Factors predicting initiation into injection drug use among street-involved youth were examined in a prospective cohort study in Montreal (2001-2005). High levels of self-efficacy had a protective effect, whereas heroin use, cocaine use, heavy alcohol use and sex work increased the risk of initiation into injection drug use.³⁷
- Qualitative interviews with 42 street-involved youth (aged 15 to 25 years) in Montreal examined social contexts and processes influencing the transition to injection drug use. Certain combinations of street life (such as early street life) and drug use trajectories (such as cocaine use) appeared to contribute to injection drug use. Important interacting factors increased the risk of transitioning to injection: poor personal assets, early rupture with primary social institutions, social integration into subcultures in which both street life and "drug trips" are fashionable, drug preferences and the local drug market.³⁸

Risk behaviours and correlates of risk behaviours among inmates

Incarceration has been shown to be associated with injecting and sexual risk behaviours and HIV transmission. The following summarizes recent evidence.

- In the VIDUS cohort from 1996 to 2005, the prevalence and correlates of injection cessation were examined among IDU. Recent incarceration was negatively associated with injection cessation, and longitudinal analyses indicated that incarceration did not reduce drug use among IDU.³⁹

- Patterns of incarceration among IDU and associations between HIV risk behaviours were examined in a prospective cohort study in Vancouver. Of 1,274 participants, 20.5% were infected with HIV. Factors independently associated with incarceration included borrowing a used syringe, lending a used syringe and inconsistent condom use with casual sex partners.⁴⁰

Risk behaviours and correlates of risk behaviours among Aboriginal people

Aboriginal people are overrepresented in Canada's HIV epidemic,¹⁵ and injection drug use and risky injecting practices are among the major risk factors.⁴¹ The following is a summary of risk behaviours and correlates of risk behaviours among Aboriginal people who inject drugs in Canada.

- The Cedar Project examined factors related to the initiation of injection drug use. At baseline, 207 participants (45%) were non-injectors, and, as of July 2007, 39 participants had transitioned to IDU (crude incidence of 19.8%). The transition to IDU was univariately associated with sex, involvement in survival sex work in the previous 6 months, ever having had a sexually transmitted infection and overdosing in the previous 6 months. Having overdosed in the previous 6 months independently predicted transition to IDU.⁴²
- The Cedar Project also found that a substantial proportion of young Aboriginal people struggling with drug dependency had been in youth detention (41%). Of female participants 71% had been sexually abused and 79% had been involved in sex work. Youth detention was associated with being male, ever injecting drugs, HIV-positive status and ever having slept on the street for more than three nights.⁴³
- The Cedar Project examined the characteristics of participants who were removed from their families and communities as children and the risk of HIV infection. Among IDU, ever having been taken from biological parents was predictive of ever overdosing, self harm, involvement in survival sex work and borrowing used syringes.⁴⁴
- A history of sexual abuse among participants in the Cedar Project was associated with several outcomes, including attempted suicide, homelessness, ever having injected drugs, having been paid for sex, current income from the sex trade, reporting 20 or more lifetime sex partners, inconsistent condom use and HIV seropositivity.¹⁴

- Trends in and factors associated with CM use were examined in the Cedar Project cohort using data collected in the period from 2003 to 2006. CM use was associated with younger age, being male, unstable housing, smoking opiates, needing help injecting and binge drug use.⁴⁵
- HIV testing among Aboriginal youth (IDU and non-IDU) who participated in the Cedar Project (2003-2005) was associated with older age, being female, single marital status, completion of high school, unstable housing, sex trade involvement, non-consensual sex, injection drug use, ever being in jail or prison and ever receiving alcohol or drug treatment.⁴⁶
- From the analyses of data derived from two prospective cohort studies of IDU in Vancouver (1996 to 2005), Aboriginal participants were found to be more likely than people of other ethnicities to be women, younger, living in Vancouver's downtown east side, involved in the sex trade, injecting cocaine daily and having had unsafe sex.¹⁵
- The Maka Project examined HIV prevalence and risk factors through an interviewer-administered questionnaire among female survival sex workers in Vancouver. The baseline HIV prevalence was 26%, and HIV infection was associated with early age of sex work initiation (<18 years), Aboriginal ethnicity, daily cocaine injection, intensive/daily crack smoking and unprotected sex with an intimate partner.⁴⁹
- Further analyses from the Maka Project found that the displacement of sex work to primarily industrial settings and side streets pushed women further from health and social supports and reduced their access to safer injection and drug use equipment. This geographic gap between sex work areas and areas of health and syringe availability was particularly noted among women who were younger, who self-identified as Aboriginal, who were active IDU and who smoked crack cocaine daily.^{50,51}

Risk behaviours and their correlates among women

According to national surveillance data, just over 30% of positive HIV test reports attributed to injection drug use have been among women,¹ and as noted in the most recent HIV estimates a slightly higher proportion of estimated new infections were attributed to injection drug use among women (29% in 2008).² The following summarizes risk behaviours and correlates of risk behaviours among women who inject drugs in Canada.

- Women IDU participating in I-Track at the Sudbury site (2005) had a significantly higher HIV prevalence than men (20.4% vs. 8.2%). Women IDU also exhibited higher levels of drug-related risk behaviours than men: they were more likely to borrow used needles or syringes (27.3% vs. 12.2%) and lend used needles or syringes (31.5% vs. 15.6%).⁴⁷
- Analyses of data from the Cedar Project (2003-2005) examined HIV-related vulnerabilities associated with sex work among young Aboriginal women. Sexual violence and drug using patterns were found to be markedly different for women recently involved in sex work. Daily injection of cocaine, smoking crack in the previous 6 months and lifetime sexual abuse were independently associated with sex work.⁴⁸

Comment

Strengths and limitations

The selected findings presented in this chapter came from a variety of recently published HIV research involving IDU in Canada. The inherent design strengths of these studies—cross-sectional and cohort, qualitative and quantitative, involving large community samples—have permitted a wide range of risk behaviours and associations to be robustly examined in this at-risk and hard-to-reach IDU population. Much of this research has generated new evidence that is critical to the development of prevention programs and policy at local, provincial and national levels.

When interpreting the findings presented in the chapter, a number of biases must be considered. HIV diagnostic data are limited to people who present themselves for testing; therefore, trends in these numbers may be influenced by testing patterns and/or improved ability to remove duplicated tests. In addition, identifying information that accompanies HIV testing is sometimes incomplete or inaccurate, and this may limit the usefulness of HIV surveillance data. The research reviewed comprised several studies that varied in methodology, study samples and research aims; for these reasons, the results may not necessarily be comparable across all studies. For more specific study-level limitations, please refer to the respective studies referenced within the chapter.

Conclusion

People who inject drugs continue to represent an important at-risk group for HIV acquisition and transmission. Risk behaviours – injection related and sexual – were reported in national behavioural surveillance surveys and other cross-sectional and cohort studies, which suggests that the potential for transmission of HIV among IDU continues to be significant.

Over the last decade, a downward trend in the proportion of positive HIV tests attributed to injection drug use among men has been noted; however, an increasing trend has been observed among women since 2003. National HIV incidence estimates for 2008 show a slight increase over 2005 in the number of new HIV infections attributed to injection drug use.

Recent research demonstrates that female IDU have unique factors that may put them at heightened risk of HIV infection. The younger IDU population is particularly vulnerable to HIV infection, as seen in reported high levels of injecting and sexual risk behaviours across targeted studies. Prison populations remain a special concern, as evidence has shown that incarceration facilitates risky injection behaviours, placing inmates at higher risk of HIV infection. Among people who inject drugs, Aboriginal people are disproportionately affected by HIV.

The issue of HIV among IDU continues to be a serious problem that requires ongoing research and surveillance that monitor risk behaviours and examines the social conditions in which IDU live and work. Such data is critical to the development and evaluation of responses to the evolving HIV epidemic among IDU in Canada.

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HIV-1 Strain Surveillance in Canada

At a Glance

- The Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program) monitors and assesses HIV strains and the transmission of drug resistance among individuals with newly diagnosed and not yet treated HIV infection in Canada.
- Although HIV-1 strain B continues to predominate in Canada (89.4% of the cumulative samples analyzed), a wide variety of different non-B strains have also been identified.
- On the basis of results from the SDR program, the likelihood of a non-B strain infection in Canada is greater among individuals of African/Caribbean origin than Caucasians and greater among those whose primary risk exposure is heterosexual sex than among those with male-to-male sex as the primary risk exposure.

Introduction

HIV is classified into types, groups, subtypes and sub-subtypes according to its genetic variability. Two types of HIV have been characterized in humans, HIV type 1 (HIV-1) and HIV type 2 (HIV-2). Both HIV-1 and HIV-2 lead to AIDS, and differences in their transmission and biologic characteristics are well documented.¹ HIV-2 is less common than HIV-1 and is found mainly in West Africa. HIV-1, which is the predominant type and primarily responsible for the AIDS pandemic, can be further divided into three genetic groups: "M" (major or main), "O" (outlier) and "N" (new or non-M, non-O).² HIV-1 infections are almost exclusively caused by group M viruses. Group M viruses are further classified into subtypes (A-D, F-H, J and K) and over 40 circulating recombinant forms or CRFs (e.g. AB, CRF01_AE).³⁻¹⁰

HIV-1 subtypes are not distributed uniformly across the globe. Many studies have been conducted to estimate the regional and global distribution of HIV-1 subtypes and CRFs.^{11,12} According to the WHO-UNAIDS Network for HIV Isolation and Characterization, approximately 50% of diagnosed infections worldwide were due to HIV-1 subtype C in 2004.¹¹ This subtype predominates in India, southern Africa and Ethiopia. HIV-1 subtype A accounted for 12% of infections worldwide. HIV-1 subtype A predominates in Eastern Europe, Central Asia, and East and Central Africa. Overall, HIV-1 subtype B was responsible for 10% of diagnosed infections worldwide and is the dominant subtype in Canada, the United States, Western Europe, Australia and some Asian countries. The other main subtypes such as G and D were responsible for 6% and 3% of HIV-1 diagnosed infections respectively. The two major recombinant forms of HIV-1, CRF01_AE and CRF02_AG, are found in West and Central Africa and Southeast Asia respectively, and each represents 5% of the burden of HIV-1 globally.

The global distribution of HIV-1 strains is continuously evolving. Through increased travel and migration, infections with non-B subtypes are increasingly being reported in other parts of the world, and additional subtypes and recombinant forms are constantly being discovered.¹³ Moreover, the proportion of non-B subtypes is increasing in areas where subtype B infection has traditionally predominated, such as North America and Europe.¹⁴⁻²⁰

This *Epi Update* describes the rationale for the surveillance of HIV strains and provides a summary of the prevalence of the different HIV strains in Canada identified through the SDR program. Additional information will be available in the next edition of the report entitled *HIV-1 Strain and Primary Drug Resistance in Canada* (with anticipated publication in the fall of 2010).

HIV Strain Surveillance in Canada

The SDR program was initiated as an integrated group of projects aimed at enhancing the national surveillance of HIV; it is a collaboration between the provinces and the Surveillance and Risk Assessment Division and the National HIV and Retroviral Laboratories, Public Health Agency of Canada (PHAC). Laboratory samples (serum from treatment-naïve individuals with newly diagnosed HIV infection) and corresponding epidemiologic data are sent from the provincial health laboratories to PHAC for HIV strain and drug resistance testing. The results are then shared with provincial and other stakeholders. One of the central goals of this program is to conduct the systematic surveillance of HIV subtypes in Canada to meet the following four main objectives.

1. Improve HIV diagnostic and screening strategies

The broad genetic diversity of HIV has important implications for screening of donated blood, the ability of diagnostic tests to reliably detect circulating HIV strains, and patient monitoring. The sentinel arm of the SDR program, through the reference services of the National HIV and Retrovirology Laboratories, addresses this goal by testing samples with atypical test results. Using knowledge of the circulating HIV strains, modifications can be made to current tests to ensure that testing accurately detects all HIV-positive individuals. This is also relevant to the safety of the blood supply, since the tests used for screening donated blood would be able to detect circulating HIV variants.

2. Inform vaccine development

The genetic diversity of HIV-1 is a major challenge to vaccine development. Information on the distribution of the viral subtypes can be used to target vaccine development and testing, since the efficacy and effectiveness of any vaccine that is developed would likely be subtype specific.^{21,22}

3. Assess HIV transmission patterns

Although genetic analyses have been used to assess the spread of HIV globally, there is little consensus on whether differences in HIV subtype affect the transmissibility of the virus in sexual²³⁻²⁵ or maternal exposures.²⁶⁻²⁹ Some studies have noted differences in the biological properties of HIV-1 subtypes,^{25,28,30} though the

meaning of these differences has yet to be determined. Knowing the distribution of HIV variants in Canada, along with corresponding epidemiologic factors, will help to assess the implications of any differences in transmissibility. The public health implications of such findings, including prevention and treatment strategies, are of special interest.

4. Assess HIV pathogenesis and progression of HIV-related diseases

Several prospective, observational studies have examined the role that genetic subtypes may play in disease progression. Some studies have suggested that viral subtype is a contributing factor to progression rates,³⁰⁻³⁴ whereas others studies indicate that disease progression does not differ according to HIV-1 subtype.^{35, 36} Note that a caveat to all these studies is that it was difficult to control for the many other variables that may affect disease progression, such as access to medical care, nutritional status, host genetic factors, plasma HIV-1 RNA level and CD4 T cell count.³⁷⁻³⁹

Recent evidence suggests that currently available antiretroviral drugs are equally effective in patients infected with different HIV-1 subtypes but that certain subtypes may develop different resistance patterns against specific antiretroviral drugs.⁴⁰⁻⁴³

Distribution of HIV-1 Subtypes in Canada

HIV-1 subtype A was first reported in Canada in 1995 from an individual of African origin⁴⁴ and HIV-2 was detected in Canada as early as 1988.⁴⁵

Cumulative results from the available data of the SDR program show that HIV-1 subtype B predominates, at 89.4%, with only 10.6% of the sampled population ($n = 4,598$) infected with non-B subtypes (see Table 1 for detailed subtype distribution).

Results from the available data of the SDR program suggest that individuals infected with non-B HIV-1 subtype are more likely to be female, younger in age at initial diagnosis, of African/Caribbean background (compared with Caucasian and other backgrounds) and to report heterosexual sex as their primary HIV risk factor (compared with male-to-male sex) (see Tables 2 to 5 for subtype distribution by sex, age group, ethnicity and exposure category).

Table 1. Distribution of HIV-1 subtypes in samples submitted to the SDR program (1985-Dec. 31, 2008)⁴⁶

HIV-1 subtype	Frequency	Percentage
B	4,109	89.4
C	258	5.6
A	81	1.8
AG	39	0.9
AE*	34	0.7
D	22	0.5
AD	12	0.3
G	7	0.15
BD	4	0.09
AB	2	0.04
BC	2	0.04
F	2	0.04
AC	1	0.02
B/AG	1	0.02
B/A	1	0.02
H	1	0.02
K	1	0.02
K/AE	1	0.02
K/AG	1	0.02
CRF01_AE**	11	0.24
CRF02_AG	5	0.11
CRF06_cpx	3	0.07
TOTAL	4,598	100

* The circulating recombinant form AE has also been referred to as subtype E.

** CRF = circulating recombinant form

Note: 1- Included in the analysis, data from participating provinces in the SDR program: BC, AB, SK, MB, ON and NS.

2- Quebec strain surveillance data are not included in the analysis but will be included in the fall report to be published later in 2010.

Table 2. Number and distribution of HIV-1 subtypes by sex

Gender	HIV-1 subtype		Total n
	B* n (%)	Non-B** n (%)	
Male	3198 (93.05)	239 (6.95)	3437
Female	894 (78.2)	249 (21.8)	1143
TOTAL	4109 (89.4)	489 (10.6)	4598

* Gender was unknown for 17 individuals with HIV-1 subtype B infection.

** Gender was unknown for 1 individual with HIV-1 non- subtype B infection.

Table 3. Number and distribution of HIV-1 subtypes by age group

Age group	HIV-1 subtype		Total n
	B* n (%)	Non-B** n (%)	
< 15	12 (40.0)	18 (60.0)	30
15-19	69 (89.6)	8 (10.4)	77
20-29	732 (86.4)	115 (13.6)	847
30-39	1310 (87.7)	184 (12.3)	1494
40-49	1092 (94.3)	66 (5.7)	1158
50-59	395 (91.9)	35 (8.1)	430
60+	158 (89.8)	18 (10.2)	176
TOTAL	4109 (89.4)	489 (10.6)	4598

*Age at diagnosis was unknown for 341 individuals with HIV-1 subtype B infection.

**Age at diagnosis was unknown for 45 individuals with HIV-1 non-subtype B.

Table 4. Number and distribution of HIV-1 subtypes by race/ethnicity

Ethnicity	HIV-1 subtype		Total n
	B* n (%)	Non-B** n (%)	
Caucasian	2431 (96.6)	85 (3.4)	2516
African/Caribbean	83 (23.9)	264 (76.1)	347
Asian/Arabic	146 (87.4)	21 (12.6)	167
Aboriginal (combined)	869 (94.9)	47 (5.1)	916
South Asian	59 (66.3)	30 (33.7)	89
Latin American	118 (96.7)	4 (3.3)	122
60+	23 (85.2)	4 (14.8)	27
TOTAL	4109 (89.4)	489 (10.6)	4598

*Ethnicity was unknown for 380 individuals with HIV-1 subtype B infection.

**Ethnicity was unknown for 34 individuals with HIV-1 non-subtype B infection.

Table 5. Number and distribution of HIV-1 subtypes by exposure category

Exposure category	HIV-1 subtype		Total n
	B* n (%)	Non-B** n (%)	
MSM	1452 (98.2)	27 (1.8)	1497
MSM/IDU	136 (95.1)	7 (4.9)	143
IDU	1257 (97.4)	33 (2.6)	1290
Heterosexual/Endemic	20 (10.8)	166 (89.2)	186
Heterosexual/Non-endemic	851 (81.6)	192 (18.4)	1043
Other	70 (69.3)	31 (30.7)	101
TOTAL	4109 (89.4)	489 (10.6)	4598

*Risk exposure was not identified in 323 individuals infected with HIV-1 subtype B infection.

**Risk exposure was not identified in 33 individuals infected with HIV-1 non-subtype B infection.

MSM: men who have sex with men; IDU: injecting drug users; Heterosexual/endemic: origin in a country where HIV is endemic (where heterosexual sex is the main mode of transmission and HIV prevalence is high, mainly countries in sub-Saharan Africa and the Caribbean); Heterosexual/non-endemic: heterosexual contact with a person who is either HIV infected or at risk of HIV or heterosexual contact as the only identified risk; Other: recipients of blood transfusion or clotting factor, perinatal and occupational transmission.

Comment

The introduction of new variant HIV strains into Canada is most likely related to travel and migration patterns from regions of the world where non-B HIV-1 strains predominate. The potential for increasing diversity of HIV-1 subtypes in Canada has implications for HIV diagnosis and vaccine development. The approval of HIV diagnostic kits in Canada is in part based on their ability to detect diverse pure and recombinant subtypes, and the potential utility in Canada of any vaccines that may be developed will need to take this subtype diversity into consideration. HIV-1 subtype surveillance creates the foundation for examining subtype-specific differences in transmissibility, pathogenicity and treatment. To address the challenges posed by these aspects of HIV strain diversity, it is therefore important to continue the systematic collection and analysis of information related to the dynamic change in HIV subtypes in Canada.

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Mission

To promote and protect the health of Canadians through leadership, partnership, innovation and action in public health.

Public Health Agency of Canada

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Primary HIV Antiretroviral Drug Resistance in Canada

At a Glance

- The Canadian HIV Strain and Drug Resistance Surveillance Program (SDR program) monitors and assesses HIV strains and the transmission of HIV drug resistance among individuals with newly diagnosed and not yet treated HIV infection in Canada.
- Preliminary observations from the SDR program of HIV drug resistance among treatment-naïve individuals with newly diagnosed HIV infection in Canada (i.e. primary drug resistance) are as follows:
 - The overall prevalence of primary drug resistance to at least one antiretroviral drug is 9%.
 - The overall prevalence of multidrug resistance to two or more classes of antiretroviral drugs is approximately 1%.
- Available data suggest that the prevalence of primary drug resistance in Canada is similar to that observed in other developed countries where highly active antiretroviral treatment is widely used.

Introduction

Highly-active antiretroviral therapy (HAART) has significantly decreased mortality and morbidity among people with HIV type 1 (HIV-1) infection¹⁻⁶ and is associated with a significant recovery of the compromised immune function.^{7,8} However, these benefits can be adversely affected by the development of drug-resistant forms of the virus.

Drug resistance is classified into categories of primary or secondary drug resistance. Secondary drug resistance refers to resistance that develops in individuals already receiving treatment. Primary drug resistance is resistance observed in treatment-naïve individuals with newly diagnosed HIV infection, in whom resistance is presumably due to the transmission of a drug-resistant variant of HIV-1. Both types of drug resistance limit strategies for antiretroviral therapy (ART), have important implications for HIV-related morbidity and mortality, and may result in increased health care costs.⁹⁻¹⁴ The emergence of drug resistance in treated populations (antiretroviral treatment-experienced patients) and transmission of drug-resistant strains to newly infected individuals are important public health concerns in the prevention and control of HIV.¹⁵

This *Epi Update* provides a summary of primary HIV drug resistance in Canada and in other developed countries and includes an overview of data from the Canadian Strain and Drug Resistance Surveillance (SDR) program, a collaboration between the provinces and the Public Health Agency of Canada (the Surveillance and Risk Assessment Division and the National HIV and Retrovirology Laboratories). Note that additional, more detailed, information from the SDR program will be available in the next edition of the report entitled *HIV-1 Strain and Primary Drug Resistance in Canada* (with anticipated publication in the fall of 2010; the current edition of this report was published in 2006¹⁶).

Evolution of Drug Resistance

ART is directed toward inhibition of vital steps in the life cycle of the virus. The most commonly used drugs used in ART target the reverse transcriptase (RT) and protease enzymes. Drug resistance largely results from changes (mutations) in the genetic material that code for these enzymes, rendering ART less effective. Although newer classes of drugs are available, the most commonly used drugs approved for the treatment of HIV infection fall into three classes: nucleoside reverse transcriptase inhibitors (NRTIs), non-nucleoside reverse transcriptase inhibitors (NNRTIs) and protease inhibitors (PIs).



The HIV virus is constantly changing, and mutations in the virus's genetic material occur on a daily basis. Most mutations do not result in the development of drug resistance, as they are lethal, reduce fitness, or even if not affecting viral growth, occur at sites that are not targeted by ART. However, under conditions in which treatment does not completely inhibit viral replication, a virus with drug-resistant mutations may begin to thrive, resulting in treatment failure. For some drugs in particular (e.g. NNRTIs), a single mutation may be associated with a high level of resistance to drugs from that same class.

Methods to Identify Drug Resistance

Genotypic tests identify mutations in the viral genetic material through sequencing the viral genes of interest. By comparing the generated sequences with databases containing resistance-conferring mutations, the presence or absence of drug resistance can be determined.

Phenotypic tests assess growth of a virus containing the genes of interest in the presence of drugs against which resistance is being determined. This test is similar in concept to antibiotic-resistance testing in bacterial culture.

Drug Resistance in Untreated Individuals (Primary Drug Resistance)

Mutations associated with drug resistance in individuals with newly diagnosed but untreated infection is thought to be the result of the transmission of a drug-resistant virus from a treated individual or from other treatment-naïve individuals (onward transmission).¹⁷⁻¹⁹ Several studies from Europe and the United States have reported mutations associated with drug resistance ranging from as low as 3.8% to as much as 20% and higher in untreated, early or acute HIV-1 infections.²⁰⁻²⁶

Primary drug resistance in Canada

Cumulative results from the available data of the SDR program show that the overall prevalence of primary drug resistance to at least one antiretroviral drug is 9% (see Table 1 for primary drug resistance results by drug class).

Regarding the time of infection, SDR program data reveal that to date the proportion of primary drug resistance among recent infections is higher than among established infections.^{16,27} This is consistent with the

Table 1. Distribution of primary drug resistance among treatment-naïve individuals with newly diagnosed infection (1996-December 2008)

	Frequency	Percentage
Wild type*	3,781	91.0
NRTI**	150	3.6
NNRTI†	108	2.6
PI‡	78	1.9
NNRTI/NRTI	20	0.5
PI/NNRTI	6	0.1
PI/NRTI	9	0.2
PI/NNRTI/NRTI	5	0.1
TOTAL	4,157	100.0

*Wild type includes polymorphisms and minor mutations in the protease gene not associated with drug resistance.

**Refers to nucleoside reverse transcriptase inhibitors.

†Refers to non-nucleoside reverse transcriptase inhibitors.

‡Refers to protease inhibitors.

Note: 1- Included in the analysis, data from participating provinces in the SDR program: BC, AB, SK, MB, ON and NS.

2- Quebec drug resistance data are not included in the analysis but will be included in the next edition of the report entitled *HIV-1 Strain and Primary Drug Resistance in Canada* (with anticipated publication in the fall of 2010).

Data source: Public Health Agency of Canada. Unpublished data to the end of 2008 from the Canadian HIV Strain and Drug Resistance Surveillance Program. Ottawa: Surveillance and Risk Assessment Division, Centre for Infectious Disease Prevention and Control, Public Health Agency of Canada.

findings of most²⁷⁻³⁰ but not all studies,^{31,32} which report a higher prevalence of primary drug resistance among recently infected individuals relative to individuals with untreated and chronic HIV-1 infection.

More detailed information and analysis will be available in the next edition of the report entitled *HIV-1 Strain and Primary Drug Resistance in Canada*.

Summary of Key Studies on the Prevalence of Primary Drug Resistance

This section summarizes findings regarding the prevalence of primary drug resistance in individuals not yet treated (treatment-naïve patients) in North America and in Western Europe.

Primary drug resistance in Canada

Data collected during the periods 1996-1998 and 1997-2005 from different cohorts in Canada have shown a prevalence of primary drug resistance ranging from 2% to 8%.³³⁻³⁵ In a study of drug resistance in newly HIV-1 infected individuals in Montreal over the period 1996-2003, the prevalence of drug resistance among recently infected patients decreased from 13% in 1997-2000 to 4.0% in 2001-2003.³⁶

Data collected through the SDR program assessed the regional variation in HIV strain and drug resistance from treatment-naïve individuals whose infection was diagnosed in 2004. Sequence information was obtained from 537 serum samples. Overall, the prevalence of drug resistance was 9.7%; however, the range varied from 5.6% to 18.4% among provinces.³⁷ An earlier analysis of data from this program found that the prevalence of primary drug resistance was higher among Caucasian men who have sex with men and higher in recent than in established infections.²⁷

A recent study by Tossonian et al.³⁸ found the prevalence of primary HIV drug resistance to be 4.7% in a population of treatment-naïve individuals who injected drugs and attended a community health centre in Vancouver. The prevalence of resistance to various drug classes in this population was 3.1% for NNRTIs and 1.6% for NRTIs, and there were no cases of resistance to PIs or of multidrug resistance.³⁸

Primary drug resistance in the United States

Different estimates of the prevalence of primary drug resistance in the United States have been reported. Overall, the prevalence among treatment-naïve individuals recently or chronically infected varied from as

low as 7% to as much as 27.3%, depending on the characteristics of the population studied, study design, sampling strategies, methods and criteria used to score the transmission of a resistant virus, survey period and geographic region.^{20-22,26,39-43} For example, studies in the last decade have reported high prevalence rates of primary drug resistance in San Diego (25%)⁴⁴ and in New York City (24.1%).⁴⁵ Other recent studies in the US among different risk groups have also found a high prevalence of primary drug resistance, which varied between 11.6% and 18%.^{29,41,42,46-48} A more recent study by Hurt et al.⁴⁹ found a prevalence of 17.8% of primary drug resistance in North Carolina patients with acute or recent HIV infections diagnosed between 1998 and 2007. NNRTI mutations were detected in 9.5% of the people infected, NRTIs in 7.5% and PIs in 3.2% of persons.

Primary drug resistance in western Europe

Overall, studies conducted in western European countries have shown variation in the reported prevalence of primary drug resistance, in line with some North American reports. This variation reflects the heterogeneity of the study design, the demographic characteristics of the population and resistance detection methodology.

Findings from two large multicentre studies suggest that the prevalence of primary drug resistance in western Europe from 1996 to 2003 was approximately 10% among recently or chronically infected individuals, and the prevalence of resistance varied according to drug class. In addition, a higher prevalence of primary drug resistance was reported in people infected with subtype B virus than in people infected with non-B subtypes.^{28,50,51}

A number of studies have found prevalence rates of less than 10%. Between 2002 and 2005, the SPREAD (Strategy to Control SPREAD of HIV Drug Resistance) Programme⁵² examined 2,793 patients with newly diagnosed HIV-1 infection in 20 European countries and in Israel, and found an overall prevalence of primary drug resistance of 8.4%. NRTI resistance was present in 5% of patients, whereas 2% had resistance to NNRTIs and 3% were resistant to PIs. A 10-year study (1996-2005) in Switzerland found rates of 7.7% for any drug, 5.5% for NRTIs, 1.9% for NNRTIs and 2.7% for PIs.⁵³ Multiple drug resistance was observed in 2% of patients. A number of other studies conducted in western European countries, including the United Kingdom, Germany, Portugal, Belgium, Italy, France and Luxembourg, have found prevalence rates of primary drug resistance ranging from 5% to 10%,^{31,54-59} whereas in other studies the reported prevalence was lower than 5%.^{25,60}

However, several studies have found higher prevalence rates of primary drug resistance in western European countries. A 2003 British study found a rate of 19.2% for any drug resistance mutation, 12.4% for NRTIs, 8.1% for NNRTIs and 6.6% for PIs.⁶¹ Similarly, a large Italian cohort of 1,690 treatment-naïve patients from 1996 to 2007 had a 15% prevalence of primary drug resistance, with a prevalence of 7% of non-B subtypes and 17.3% of B subtype samples.⁶² A number of other studies in different western European countries have also found prevalence rates higher than 10% among acutely, recently or chronically infected people and among those with newly diagnosed infection.^{62,63}

Comments

Primary HIV drug resistance has been observed in most countries where HAART is used. Although the interpretation of results is difficult and continues to evolve, people infected with drug-resistant variants of HIV may be at increased risk of drug failure despite being therapy naïve. Continued surveillance of primary drug resistance is needed not only to develop guidelines for initial therapy but also to better understand and prevent the transmission of resistant HIV.

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